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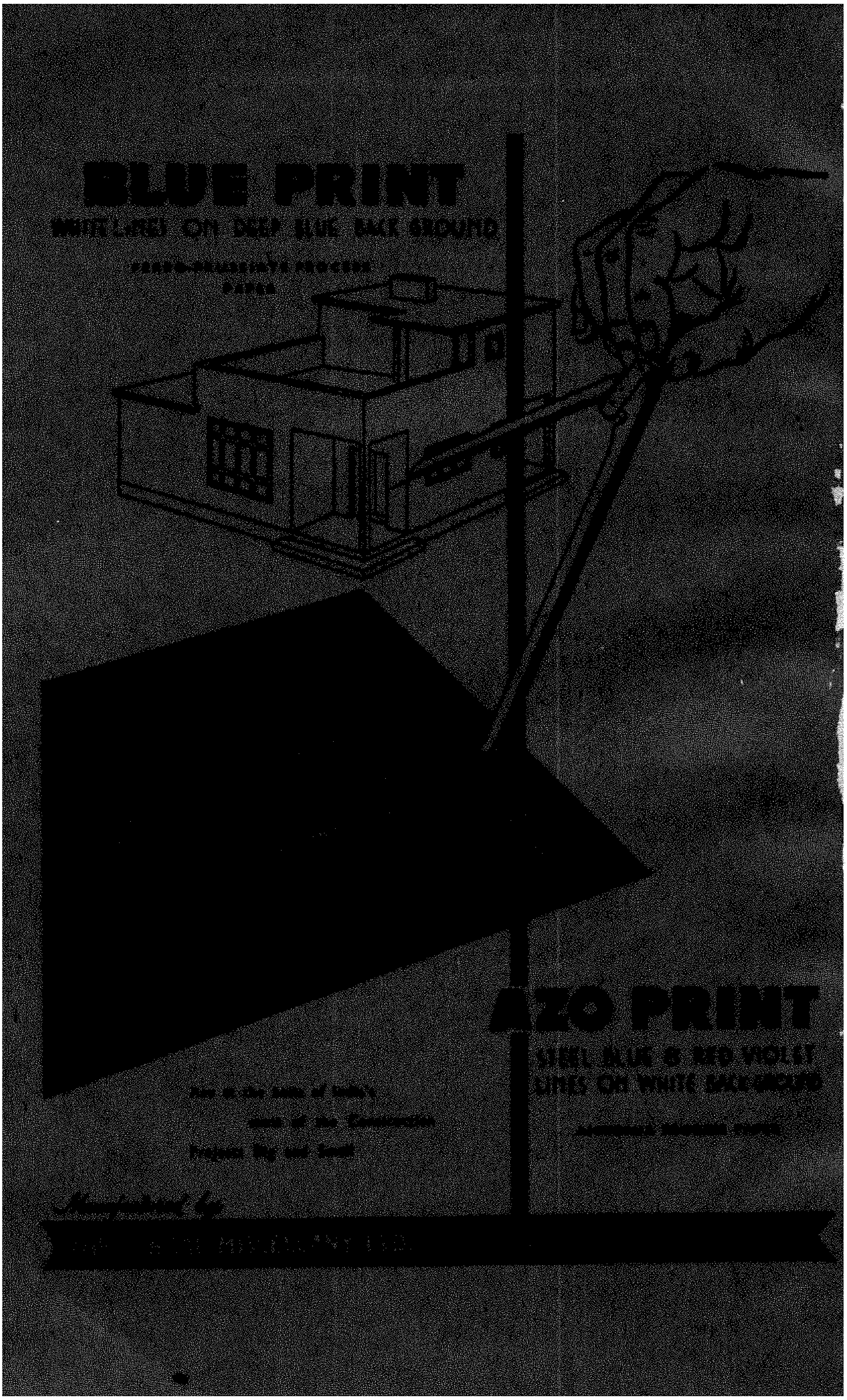

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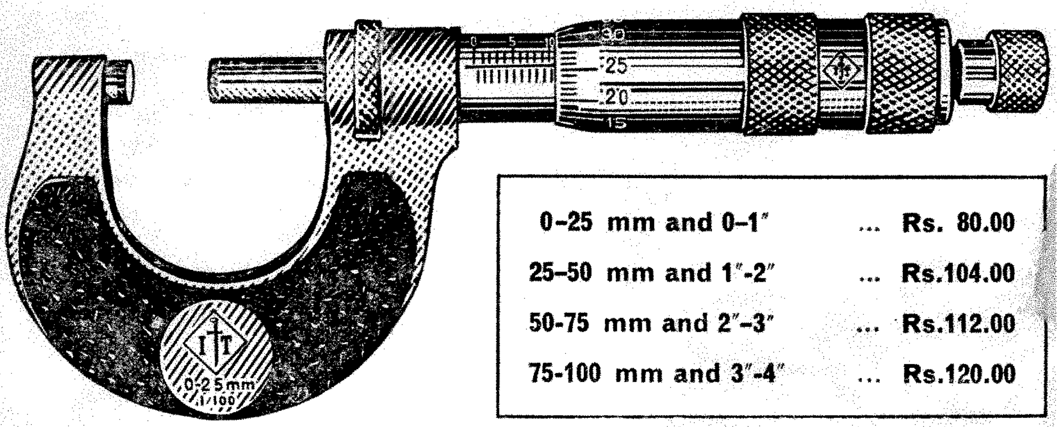

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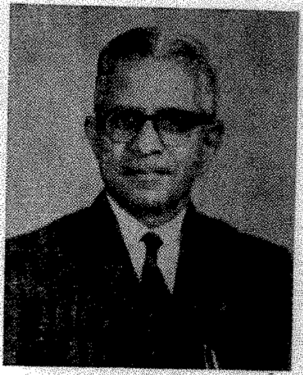
ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Mysore Centre

Chairman's address by Shri R. A. Rajagopal, M.I.E., at the 30th Annual General Meeting of the Centre on December 26, 1964.

After welcoming the Chief Guest, Shri S. Nijalingappa, Chief Minister of Mysore, and other invitees, Shri Rajagopal thanked the Committee of the Centre for electing him Chairman for 1964-65.



Delivering the Chairman's address he said, 'Contract profession in the present times is as difficult and requires as much planning as the execution of a large factory or manufacturing organisation. Present day contracts run to several lakhs and sometimes even to several crores of rupees and this money either belonging to the government or to private industrialists and financiers has to be spent usefully and to the maximum advantage. To have the confidence of the organisations who entrust such large volume of works to the contractors and to ensure that these large amounts of money are used to the best advantage, the set-up and organisation of the contracting firms in the present days has to be totally different from what it was about 25 years ago. The contracting firm has to do elaborate work study methods similar to those being done in organised factories and see how far the costs can be kept at the minimum both to the advantage of the client and to the contractor himself. The quality of the work should not be sacrified to keep the costs low and the contractor should maintain the same standards that an established factory would have, whether it is in the selection of various raw materials, or in the testing of the materials, before they go into the project or construction. Also, like finished products in a factory undergoing rigorous tests, the contractor must also test his mixes of concrete, mortar, etc., periodically to ensure a good quality in the finished contract. In a factory, it is possible to select the various raw materials or semi-finished goods that go into the production of the finished article as they are invariably bought according to their requirements from established manufacturers who themselves would have exercised a good amount of care in the products sold by them. For a contractor, the selection of the materials for a project presents many hurdles and difficulties. As most of the materials like stone, jelly, bricks, mud, sand and other articles have to be procured from natural resources and as the quality of these products vary widely from place to place, and from State to State, the problems of the contractor are more difficult than those of industrialists. The contractors should try as far as possible to standardize and restrict the use of many varieties of articles. For this purpose, research and development of all the materials that are now being used for construction has to be carried out, and also to find out materials which would perhaps be most economical for construction, or speed up the construction, or ultimately save in the total cost of construction. Therefore, contractors must work in close association with research and testing laboratories and engineering colleges and others and take their advice and guidance, and must not hesitate to refer their problems to them.

Contracting firms should have their own technical design and drawing office. They must be able to give competitive design and quote for the completed project according to their own design. In a competitive era like the present one, this can be achieved only if the contracting firms employ highly qualified technical personnel who are capable of handling such work. The present system of the Mysore Government is to invite tenders for most of the building and other projects, and the Government gives the design details to the contractors. As the Public Works Department has not set up a central design section, more often than not, the designs have to be furnished by the executive engineers and others in charge of the execution of the works. In some cases, reference is made to the higher authorities and thus a lot of time is usually wasted in getting designs approved. I have found in practice that usually detailed designs are not furnished by the P.W.D. at the time of calling for tenders and these aspects are left to be detailed and worked out at a later stage. Even detailed drawings are not available in most cases at the time of tendering. The Late Shri B. R. Manickam, who was chairman of the Mysore Centre for 1961-62, 1962-63 and 1963-64 and was throughout his service closely associated with buildings, in his Address last year, made a mention of the reasons for the wide difference between the budget estimates and the actual cost of the finished works. This, as explained by him, was due to the pressure brought on engineers to start works without correct investigation or estimates having been drawn up. In the context, I may venture to make a suggestion that, in view of the increasing volume of construction activity all over the country, the question of preparing a feasibility report and inviting comparative estimates from more than one firm of consulting engineers may help in reducing the difference between the projected demand and the actual expenditure. If the government does not have a central designs organization and if the contractor does not have qualified staff to do the designs, they may consider the entrusting of reinforced concrete design, structural steel design, and such other designs, to private established specialists in the field. By this, the work can also be executed speedily, and when compared with the total cost of the work, the money paid for such designing work is negligible. Even established architects, if they do not have a design section, entrust the designing of the R.C.C. and structural work to firms specializing in this field. This has to be done only if the contracting firm has not got the technical personnel to undertake this work.

Another aspect which I would like to touch upon in the contracting line is regarding the terms and conditions of agreement and award of contract works. The contract agreement form, which was being used perhaps 30 or 40 years ago, is still being adopted by the government. These forms are very antiquated and always one-sided and it is high time that such forms are revised and made more realistic. The Indian Standards Institution had appointed a sub-committee to evolve a form of contract which would be reasonable and at the same time effective. This form, when ready, could be used as a model form.

The Mysore P.W.D., the C.P.W.D. and the M.E.S. have now introduced the system of registration of contractors, and contracts are awarded only to registered contractors. Contractors are registered into various categories mostly depending on their financial standing. The system of registering contractors is good as it eliminates any one from entering the field and doing some work and later leaving the field if the work is not to the satisfaction of the executing authorities. My views regarding registration of contractors are that financial considerations alone should not be the main criterion for registering or classifying contractors into the first, second or third grades. No doubt, financial stability is necessary for a contractor for carrying out the large volume of work entrusted to him, but other considerations like the technical staff engaged by him, the performance of the contractor in the previous contracts, etc. should be the main consideration for the registration of contractors.

About 35 years ago when I was a student in the engineering college, the number of studentf taking civil engineering as their optional subject was the highest. This was because civil engineers then felt that there were greater employment opportunities for them and also greater opportunities existed for them to practise as architects, consulting engineers or contractors. There is an impression in the minds of people that contract work is a very paying line and contractors make huge profits. I am afraid I have to contradict this impression. More often than not, the multipurpose projects, bridges, etc., are far away from towns and civilization and the contractor has to start the work by clearing the jungle and has to invest a large sum of money on labour colonies, machinery, tools and plant, to enable him to finish the work according to schedule. Large sums have to be paid as advance for labourers and the tendency for the labour is always to migrate from one place to the other, irrespective of whether they have taken ana dvance or not. Further some years ago, when contractors were few, skilled and semi-skilled labourers were available in plenty. Unlike factories and other industries where they have a regular programme of training artisans and apprentices and have training schools in the contracting field, there is no such school or training facilities for training masons, carpenters, painters, etc. Unfortunately, skilled workers in the building trade have not been accorded the same status in society as has been accorded to skilled workers in industrial establishments. In developed countries, a good mason or a carpenter earns much more than an industrial worker, and it is time that we, in India, think of providing suitable incentives to the younger generation to train themselves in skills that are essentially required for the cons- truction industry, and they should have the same incentive to work as in a factory. I like to emphasize that not only the building industry but the persons associated with the industry must treat it as such and organize it as an industry if we are to achieve a stable set-up which will eventually help us reduce the cost of construction and also develop new materials and methods of construction.

I am also informed that students these days prefer branches of engineering other than civil. This situation might have been caused by a temporary surplus of civil engineers trained in the last few years. If the development and construction activity in the country has to increase in tempo, and the cost of construction should be reduced and new developments are reguired in materials and methods, this tendency of the younger generation to feel shy of obtaining training for the civil engineering profession must stop. The building industry should therefore employ more engineers who will work on methods improvement and cost reduction. It is time that the government or the labour department start schools for training the necessary skilled labour for contractors. The amount to be invested by a contractor is fairly heavy and including the tender deposit, retention money and working capital, the sum invested comes to nearly 15 to 25% of the total cost of the work. The government has started organizations like the National Projects Construction Organization to execute major multipurpose projects and the National Buildings Construction Corporation to execute building works. These concerns, more often than not, do not tender with other contractors and are given works on negotiated rates and sometimes on a cost *plus* percentage basis. I recently read a report that the National Buildings Construction Corporation, during the last two years, sustained losses to the extent of over twenty-five lakhs of rupees each year. Such being the case, private contractors making huge profits is not correct. No doubt, there is profit in contract work, but considering the investment and the risk that the contractors undertake and various other factors, it is not as remunerative as people seem to think.

The Second and the Third Plan have brought in new employment opportunities and also new fields for engineers to practise. A few years ago we did not have industrial engineers, management consultants, aeronautical engineers and chemical engineers. The several major projects being executed both in the public and private sectors have created employment opportunities and also opportunities for engineers to practise in the above fields. I like here to mention a few more fields which are open for practising engineers. Various insurance companies are on the look-out for practising engineers for assisting them to assess the machinery for insurance purposes or to recommend for insurance the proper upkeep of machinery in factories. Various small scale industries are started by industrialists who have some capital, and as many of these industrialists do not have technical collaboration with established industries abroad, they have various problems in the selection of proper machinery, and proper maintenance, lubrication, etc. of their machinery. Several cottage industries manufacture machines for these small scale industrialists, and these machines are called upon to bear much more strain and load than they have been designed for. These small scale industrialists are always on the look-out for qualified and independnt engineers who could help them either with the choice or with the upkeep of their machinery. I am of opinion that this is a new field which engineers may profitably engage in.

One of the important events which took place in 1964, was the merger of the 100-year old Mysore Engineers Association with the Institution of Engineers (India). The Mysore Engineers Association building near the Engineering Government College, Bangalore has been set apart for starting a research centre under the auspices of the Institution of Engineers. A preliminary meeting was convened with all the chief engineers who have readily consented to give their help and guidance for this research centre and this centre will be inaugurated early in January. This centre will supplement the work being done by similar research centres and will not in any way compete with the practising engineers. We are making only a modest beginning and in due course, I hope this research centre will function as a full-fledged unit for the help of the engineering profession. I take this opportunity to appeal to all the members of our Local Centre to refer to this research centre any technical problems they may have as it is proposed to have a full-fledged panel of consultants to help tackle such problems.'

Summaries of Papers Published in the Journal, vol. 45, no. 7, pts. CI 4, ME 4 and MM 2, March 1965

CIVIL ENGINEERING DIVISION

Application of Boundary Layer Control to Design of Spillways

Dr. K. C. Asthana
Associate Member

Boundary layer control was not used before in the design of hydraulic structures. In an attempt to apply the methods of boundary layer control to the design of spillways, a series of experiments were done with the object of eliminating the boundary layer separation, thereby reducing or eliminating the negative pressures on the spillway for heads far in excess of the design head of the spillway. In this paper, the details of the experiments are described and the results discussed. Different obstructions, covering the entire width, were placed at different locations along the centre line of a Creager profile spillway, and their effect on the pressure distribution over the surface of the weir was recorded. From the results of the experiments, discussed in the paper, the effectiveness of boundary layer control in the design of spillways is established beyond any doubt.

Flume Studies on Natural Roughness in Rigid Open Channels

V. K. Chithambaran
Non-member
and
A. G. Mirajgaoker
Non-member

This paper presents the details of the experimental works carried out to study the effect of large natural roughness elements in open channels. To introduce roughness in the channels, gravel of $1\frac{1}{2}$ in. to 2 in. size was used. Four different placements were tried on a slope of 0.0054. It was observed that Chezy's resistance function, $\frac{C}{\sqrt{g}}$, is logarithmically related to the relative roughness as suggested by the previous research workers. An exponential relationship between Chezy's resistance function and a new

parameter, K, is found to give a good approximation. Certain other parameters in the paper which are useful in the study of very rough channels are also discussed in the paper.

Disastrous Building Collapse at Yeotmal—Engineering Analysis of a Serious Construction Failure

D. R. Dalvi
Associate Member

and

M. M. Inamdar
Associate Member

The collapse of the Khoja Jamatkhana building in the district town of Yeotmal in Maharashtra State on August 20, 1963, is considered unprecedented in engineering history. Independent of the special committee of enquiry appointed by the Maharashtra Government, the authors conducted an on-the-spot enquiry from August 24, 1963 into the causes of the building failure. In this paper, the details of the enquiry conducted by the authors are described and a theoretical analysis of the various civil engineering aspects involved in the failure is presented. From the analysis of the causes of failure, the authors have also suggested the formation of special committee of experts to under- take periodic inspection of the public buildings in the country.

Buckling of Columns by Matrix Method

Dr. P. Dayaratnam
Non-member

and

K. Krishnamacharyulu
Associate Member

This paper presents a brief historical background of the study of the buckling of columns. Two methods of determination of buckling of columns with the help of matrix operations are given. One illustrative example of a column, with torsional springs supporting three loads and moving with an upwards acceleration, is worked out by both the methods. A classical method of determination of the buckling load of a column with variable moment of inertia, where the moment of inertia varies as a step function, is very difficult. An illustrative example of buckling of a column with the moment of inertia varying as a step function is discussed with the help of matrix methods. Another illustrative example of buckling of a continuous columns with variable moment of inertia is also worked out with the iterative technique.

Earthquake Resistant Design of Buildings

Dr. Jai Krishna

Member

and

A. S. Arya

Associate Member

A vast area in India, lying along the Himalayan ranges and the Kutch, has experienced a large number of earthquake shocks in the past and it continues to do so at present. The adjoining countries, *e.g.*, Burma, Tibet and Nepal, have faulted formations which cause earthquakes close to the Indian border resulting in damage to the structures in this country. So far, the major portion of this region was thinly populated; but the rapid pace of industrialization is inducing large numbers of people to settle in these areas. Hence, the problem of considering as to how the present methods of construction of buildings are to be modified so that the damage to life and property due to future eathquakes is minimized, has become important. An attempt has been made in this paper to explain the behaviour of buildings and building frames when subject to earthquake forces and the basic principles that should govern the improvements in their design without heavy additional cost.

Flat Slab Design

Dr. A. S. Khanooja

Non-member

Flat slab design is governed mainly by the moments and hence, only the determination of moments in an inner pannel of a flat slab is dealt with in the paper. The moments for an inner pannel of a flat slab are compared according to the different methods of design laid in the specifications laid down in the different countries and the theory of elasticity according to Lewe and Marcus. The comparison shows that there is considerable deviation in the results found by the different methods and they do not agree also with the elastic theory which is probably the basis of all the design methods. Hence, for a designer, it becomes difficult to choose a suitable method of design for practical use. The determination of moments according to elastic theory requires considerable calculation work. In order to simplify the calculation work for practical purposes, several formulæ and graphs for the calculation of moments are given in this paper, which are in better agreement with the elastic theory than the existing methods of design. In order to check the theoretical results, several experiments were carried out on gypsum models and the results show good argeement with the suggested method of design.

Moment Redistribution in Reinforced Concrete Continuous Beams

P. Purushothaman

Non-member

Arbitrary reduction in bending moments at critical cross-sections of continuous beams is permitted by the Indian Standard (IS : 456-57, clause 6-10-6) and the British

Code of Practice (C.P. 114-1957). Experiments were conducted by the author to examine the behaviour of continuous beams designed on the above basis, when loaded to destruction. The experiments indicate that the above design procedure does not impair the strength of continuous beams; but deflections and crack widths at working loads exceed the acceptable limits. In this paper, the details of the experiments conducted in the U.S.A. are described and designs based on the ACI Code (ACI : 318-1956) given.

Well Sinking in Gowthami Bridge Construction

T. A. Ramayya
Associate Member

The construction of a bridge across the Gowthami River, a tributary of River Godavari, near Alumuru on the diversion of the National Highway 5 in East Godavari District of Andhra Pradesh has fulfilled a long-felt need. The foundation consists of dumbel-shaped wells taken to a depth of 100 to 110 ft. below the bed in the case of most of the wells and even up to 120 ft. in the case of a few wells This paper describes the experience gained in the construction of the bridge and brings out the problems involved in sinking the dumbel-shaped wells to such huge depths. This paper also deals with the cants encountered and the various methods adopted to rectify them. The non-adoptability of the tremie for bottom plugging in very deep wells and the method adopted for bottom plugging in this bridge work are also discussed briefly.

Design of Revised Profile for Bhakra Dam Spillway

Dr. H. L. Uppal
Member

T. D. Gulati
Non-member

and

B. D. Sharma
Non-member

The crest of the Bhakra dam spillway was originally designed at EL. 1645 for a maximum reservoir elevation of EL. 1685. In 1959, however, it was decided to raise the maximum reservoir level by 5 ft., *viz.*, to EL. 1690 and accordingly the crest profile was redesigned for the changed conditions. Model studies were conducted on two models of different scales to examine the revised design of the spillway profile in respect of pressure distribution, water surface profile, total overflow discharge and

conditions of flow in the stilling basin, and a comparison was made with the corresponding data of the original design. The studies were made with the maximum reservoir level of EL. 1690 for both the conditions of overflow, *viz.*, (i) with gates applied, and (ii) with gates fully open. Besides determining the value of the coefficient of discharge for the revised profile and the studies mentioned above, other important studies connected with the raising of the lake level were also made. It is shown that a rise of 5 ft. in the maximum reservoir level results in an increase in discharge intensity at the crest from 1,000 to 1,170 cusec. per foot and an increase in the value of the coefficient of discharge under the ungated conditions from 3.98 to 4.17. Under the gated conditions, however, the value of C ranged between 0.99 and 0.77 as the gate opening varied from 5 to 20 ft. Another important point found out was that as the reservoir level rose beyond EL. 1685, subsidiary jets started forming along the central and the side training walls which shot past the designed heights of the training walls with the lake level at EL. 1690. Spilling took place over the walls. The turbulence in the stilling basin also increased considerably. The results of the model studies are presented in this paper.

DOMES, PLATES AND SHELLS GROUP

Buckling of Funicular Shell of Square Plan

Dr. P. Dayaratnam
Non-member

The paper presents a method of the determination of buckling load of funicular shell, square in plan, by energy method. The equation to the surface of the shell given by Ramaswamy is re-arranged to suit the problem. The expression for the surface of the shell is found to converge very rapidly. The total internal strain energy of the shell due to bending and stretching of the shell is minimized and the buckling load obtained. The buckling load of such a shell is compared with the buckling load of a square plate subject to compressive force on both the edges. It is found that the buckling load of the shell is several times greater than the buckling load of the square plate. The high stiffness of the shell against buckling is found to be mainly due to the shape of the shell.

RAILWAY ENGINEERING GROUP

Welded Rails in Rail Track

H. N. Sil
Member

In this paper, the functions and behaviour of welded rails in rail track are discussed. The length of the welded rails could be increased only after satisfactory test results were obtained by the research workers. At present, a stage has been reached when half-a-mile to one mile long welded rail tracks are a common feature in the Western countries. In India, the progress has been rather slow since the use of welded rails was adopted just before the second World War. With the introduction of electric traction in various parts of this country, there has been a concerted drive in the use of welded rails and progress in this sphere has so far been quite commendable.

MECHANICAL ENGINEERING DIVISION

Kinematic Analysis of Cam Mechanisms

S. V. Kulkarni
Associate Member

In this paper, the analytical expressions for velocities and accelerations of the followers of a few types of cam mechanisms are derived. Simple graphical methods are also developed to determine the same and proofs of the graphical constructions given. It is also shown how the results for certain types of cam mechanisms can be derived from the general relationships.

Effectiveness of Fuel Cetane Number for Combustion Control in Bi-Fuel Diesel Engine

B. S. Murthy
Associate Member

and

L. G. Pless
Non-member

A ASTM-CFR cetane method engine was adapted to permit carburation of either liquid or gaseous fuels concurrently with injection. Such a system is sometimes called 'manifold fumigation'. Four fuels covering a broad range of cetane number were carburetted while injecting either a high or low cetane fuel. The carburation rate was about 25% of the total heat input, which was held constant for all the tests. Methanol and propane were inducted in other tests. Ignition delay, as compared with full load injection only, was reduced with all except the lowest cetane fuel carburetted. Delay decreased with increasing cetane number of the carburetted fuel. Audible combustion noise was greatly reduced with the carburation of high cetane fuels when the low cetane fuel was injected. With the high cetane fuel injection, the entire combustion noise level was lower, and further reductions were not evident when either high or low cetane fuel was carburetted.

Concurrent carburation of fuel improved the full load thermal efficiency up to a certain cetane number range. In some cases, the standard operating conditions of the cetane method did not permit optimum energy release and hence the efficiency suffered.

At a carburation rate of 12% of total heat input, methanol would not fire at the compression ratio for standard ignition delay for the high cetane injected fuel. The compression ratio had to be increased to keep the engine firing. The ignition delay with methanol at the higher compression ratio used when injecting the low cetane fuel was longer than with any other fuel tested. Despite this, methanol improved thermal efficiency because its high latent heat resulted in reduced mixture temperature and increased volumetric efficiency. Audible combustion noise, peak cylinder pressure, and rate of pressure rise increased with the increasing rate of propane carburation. Literature data indicate that even well designed engines operated at optimum conditions show the benefits of 'manifold fumigation'. Fumigation may increase the efficiency at full load by a combination of better air utilization, decreased ignition delay and faster combustion.

Transitory Movement of Rotor on Passing Through the Critical Revolution

A. Ripianu
Non-member

The passing of rotors through a critical movement is accompanied by transitory movements which do not appear when the rotor revolution is remote from the critical revolution. To investigate the transitory movements, a shaft of circular cross-section supported at the ends on two simple bearings is considered. A disc is fixed in the middle of the shaft which represents the rotor, with an eccentricity, e, against the shaft. The plane of the disc is perpendicular to the geometric axes of the shaft, and e represents the distance from the centre of gravity of the disc to the shaft axis. The effects of elastic hysteresis of the material of the shaft as well as the shaft weight are neglected, the shaft mass being considered negligibly small as compared with the mass of the disc. In this paper, the transitory motion represented by the relative rotary motion of the plane of flexion of the shaft in relationship with the rotation of the shaft (disc), is studied with special reference to the particular case when the revolution of the shaft (disc) is constant and equal to the critical revolution, n_{cr}.

Economics of Metal Cutting

K. C. Sahu
Non-member

and

S. K. Basu
Associate Member

This paper deals with a critical analysis of the various metal cutting parameters for obtaining the most economic cutting conditions which result in the least possible cost of machining. The various exponents of the existing tool life equation are evaluated by experimental results as well as by an analytical approach through Buckingham's method of dimensional analysis. The existing tool life equation as suggested by various

authors is not an exact equation in the sense that it does not consider the influence of the rigidity of the work-tool combination under the steady working condition. On the basis of the theoretical analysis and the experimental results obtained by Basu and Gupta,[10] the authors suggest certain modification in the existing tool life equation to include the effects of hitherto neglected parameters like $\frac{L}{D}$ and D.

A Survey of Gas Lubricated Bearings

B. D. Shiwalkar

Associate Member

Gas lubricated bearings, though conceived as far back as 1854, have come to the forefront recently owing to its suitability under certain circumstances in which liquid lubrication fails. There are two basic types of gas lubricated bearings, *e.g.*, hydrodynamic and hydrostatic. Both types can be used for supporting axial or radial loads. Hydrostatic or pressurized bearings are used in the case of high unit loads, while hydrodynamic bearings are used where a constant source of high pressure gas supply is not available. Stability is the chief deterrent for the use of gas lubricated bearings. Gas bearings can be manufactured with the help of commonly known processes of manufacture, although more accurate surface finish is required for the gas bearings. The clearances between the bearing elements are also much smaller in the case of gas bearings which require careful design of the supports. Bearing materials pose a problem in the case of hydrodynamic gas lubricated bearings. The application of liquid lubrication will not suffer greatly due to the advent of gas lubrication which can be used with advantage only under special circumstances.

MINING AND METALLURGY DIVISION

Working with Bucket Wheel Excavators

R. Bhadada

Associate Member

Bucket wheel excavators are used in the Neyveli lignite project and consideration is being given for their use at the Palana open cast scheme. These are continuously digging excavators and thereby their productivity is uninterrupted. As such, the bucket wheel excavators are expected to find much use in India, specially in the deposits where the effective ratio is high and the overburden is soft to medium hard. The main characteristics of bucket wheel excavators used in India are given in this paper, besides a general description of the various types of bucket wheel excavators. The paper is intended to give information about the various aspects of bucket wheel excavators including bucket emptying system, bucket wheel protection, electrical equipment, control and stability of the excavator in the case of unusual loads. Various methods of excavation and cutting with a bucket wheel excavator are also described.

INSTITUTION NOTICES

Revised list of Referees for Students appearing in Section B of the Associate Membership Examination

A fully revised list of Referees from various local Centres and also from Nepal with their membership numbers and addresses are given below. Referees are classified according to their branches of engineering which is denoted by the letters within brackets, *viz.*, C for Civil; M for Mechanical; E for Electrical; CH for Chemical; MM for Mining and Metallurgical; PH for Public Health, ET fot Electronics and Telecommunication.

Andhra Pradesh Centre

1.	AM	7097	Akthur Husain (E) c/o Dr. Khursheed Husain, 11-5-335 Red Hills, Hyderabad.
2.	AM	7668	K. V. Appa Rao (M) Reader in Mechanical Engineering, College of Engineering, Andhra University, Visakhapatnam 3.
3.	AM	1295	P. V. Apparao (C) Chartered Engineer, 8/1A Official Colony, Maharanipet, Visakhapatnam 2.
4.	AM	1136	S. K. Badrinath (PH) 10-2-289/8 Shantinagar, Hyderabad 4.
5.	AM	4094	S. Balasubrahmanyam (C) Tests and Control Engineer, Nagarjunasagar Project, P.O. Vijayapuri North, District Nalgonda.
6.	AM	5565	Prof. S. L. Balasubrahmanyam (M) Professor of Mechanical Engineering, College of Engineering, Kakinada.
7.	AM	4302	G. Bapurao (C) Executive Engineer, Heavy Electricals Ltd., B-1-174 Fateh Maidan Road, Hyderabad 4.
8.	AM	9056	I. Basavaraju (E) Deputy Chief Engineer (Electrical), Office of Chief Engineer, Electricity Opposite Ballavista, Khairatabad, Hyderabad.
9.	AM	5161	P. Bhyravamurthy (C) Assistant Professor of Civil Engineering, Engineering College, Kakinada.
10.	M	2933	N. V. Chalapathi Rao (C) Superintending Engineer, Nagarjunasagar Right Canal, Hill Colony, P.O. Vijayapuri North, District Nalgonda.
11.	AM	4419	R. Chandrasekara Rao (C) Executive Engineer, Inspection & Construction Division No. 2, Nagarjunasagar Dam, P.O. Vijayapuri North, Nalgonda.
12.	M	2766	G. V. Chelapathi Rao (MM) c/o MacMan (P) Ltd., Masulipatam Road, Vijayawada.
13.	M	2753	P. N. Damodaran (C) Principal and Professor of Civil Engineering, Engineering College, Kakinada.
14.	M	2439	B. B. Das Gupta (M) Mechanical Engineer, Hindusthan Shipyard (P) Ltd., Gandhigram, Visakhapatnam 5.
15.	AM	8621	M. J. David (C) Principal, Government Polytechnic, Vijayawada, Krishna District.

16. AM 6502 P. Ethirajulu (C)
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17. M 2730 G. B. Gadre (M)
Chief Engineer, Body Building, Hyderabad Allwyn Metal Works Ltd., P.O. Sanatnagar, Hyderabad.

18. AM 6174 B. Gopallkrishna Murthy (C)
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19. AM 2775 S. Gopalan (C)
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20. M 2962 M. Gopal Rao (C)
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21. M 2089 Guru Pershad (M)
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22. AM 5860 G. K. S. Iyengar (C)
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23. AM 9051 Captain V. E. Joseph (M)
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24. AM 3383 F. J. Jussawalla (M)
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25. M 1081 M. A. Kadeer (C)
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26. AM 2926 K. K. Kamalakar (M)
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27. AM 8572 A. S. Kameswar Rao (M)
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28. AM 3257 J. Karra (C)
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29. AM 1448 S. S. Kosnam (C)
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30. AM 6369 B. Kotaiah (M)
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31. AM 4223 K. Krishnamacharyulu (C)
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32. AM 1928 C. Krishnamurthy (E)
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33. AM 5840 D. Krishnamurthy Rao (C)
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34.	AM	2973	B. Krishnarao (M) Deputy Estate Engineer, Industrial Estate, Vijayawada.
35.	AM	5080	P. Krishnareddy (C) Railway Superintendent, The Nizam Sugar Factory Ltd., Shakkarnagar, Nizamabad District.
36.	AM	1065	B. R. Krishniengar (C) Retired Excutive Engineer, P.W.D. Gokul, Hardikarbagh, Himayatnagar, Hyderabad.
37.	AM	3954	G. Kutumbarao (M) 29-28-4 Suryaraopet, Vijaywada.
38.	M	2080	K. Kondayya (M) Retired Superintending Engineer, 47-10-8 Dwarkanagar, Visakhapatnam 4.
39.	AM	6661	M. Lakshmanaswamy (C) Executive Engineer, P.W.D., Kalahasti, Chittor District.
40.	AM	6677	N. Lakshimnarayana (M) Near Olcott Theosphical Lodge, Edepalli, Masulipatam.
41.	AM	4178	S. Lakshmaiah Chetty (C) Assistant Engineer, Zilla Pershad, Mahabubnagar.
42.	AM	4774	Y. Madhavendrarao Naidu (C) Executive Engineer, PW.D. Godavari Eastern Division, Dowlaishwaram, East Godavari District.
43.	AM	1526	N. R. Magal (C) Engineer & Contractor, Phulbagh, Himayatnagar, Hyderabad.
44.	M	1735	V. G. Mohanraj (M) Principal, S.M.V.M. Polytechnic, Tanuku, District West Godavari.
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46.	AM	2057	Mohammed Zafer Mohiuddin (C) Garrison Engineer, M.E.S. Mudfort, Secunderabad.
47.	M	1613	C. V. D. Murthy (E) Retired Director of Technical Education, 60 Marredpally, Secunderabad.
48.	AM	1860	C. N. Muire (E) Executive Engineer, Transmission Line Division, Electrical Department, Mint Compound, Hyderabad.
49.	AM	5830	J. A. Murray (C) Superintending Engineer, (C & D), Office of the C. E. (Civil), Electricity Department, 5-9-259 Kingkoti Road, Hyderabad.
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51.	AM	4957	Prof. M. Muthukrishnudu (E) Professor of Electrical Engineering, College of Engineering, Kakinada.
52.	M	1654	I. Nagabhushanarao (C) Civil Engineer, M/s Gannon Dunkerley Ltd., Maharanipet, Visakhapatnam 2.
53.	AM	4140	K. Nagabhushanarao (C) Retired Executive Engineer, Ramaraopet, Kakinada.
54.	AM	6142	G. V. Narapareddy (C) Engineer & Contractor, B/O Pattabhipuram, Guntur 4.

55. AM 3844 P. Narasiah (M)
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56. AM 10206 K. L. Narasimhacharulu (C)
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57. AM 4634 A. Narasinga Rao (C)
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59. M 1106 V. G. Panvalkar (C)
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60. M 1792 R. M. Patri (M)
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61. AM 4761 R. Prabhala (C)
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62. AM 6968 P. V. S. Prasadarao (C)
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63. AM 6916 P. B. Punniah (C)
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64. AM 6851 Dr. J. Purushottam (C)
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65. AM 1691 M. Raghavaiah (C)
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66. AM 8844 T. S. Raghavan (C)
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67. AM 6706 A. G. Raghottamarao (C)
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68. AM 6659 A. Rahman (C)
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69. M—2318 M. A. Rahman (C)
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70. AM 5878 R. L. Raju (C)
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71. M 946 Dr. S. P. Raju (C)
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72. M 2769 K. Ramabrahman (C)
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73. AM 2409 T. V. Ramchandra Rao (C)
Chartered Engineer, Rowjee Press, Adoni, District Kurnool.

74. AM 8870 T. V. Ramanarao (C)
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75. AM 7642 G. Ramanareddy (M)
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76.	AM	5836	K. S. Ramanathan (M) Chief Engineer, Andhra Sugars Ltd., Tanuku, District W. Godavari.
77.	AM	2389	S. T. L. K. V. N. S. Ramanujachari (M) Retired. Mech. Expert, 3/6/703 Himayatnagar, Hyderabad.
78.	AM	6834	C. V. Ramarao (C) Assistant Engineer (Highways) 12/4, R.T.L.I.G.R. Barakatpur Hyderabad.
79.	AM	1803	J. V. Ramarao (E) Executive Engineer (Elec. & Mech.) Office of the S.E. (Tech. Project), A.C. Guards, Hyderabad.
80.	AM	1883	P. S. Ramarao (M) Head of Mechanical Engineering Section, Government Polytechnic, Visakhapatnam.
81.	AM	3464	T. V. S. Rama Rao (E) Electrical Engineer, Nellimarla, District Visakhapatnam.
82.	AM	6484	V. Ranganatha Rao (C) Executive Engineer, P.W.D., Anantapur.
83.	AM	4166	A. P. Ranganathaswamy (C) Chief Engineer, Nagarjunasagar Dam, Vijayapuri North, Nalgonda.
84.	AM	6351	K. C. Rao (M) Deputy Director, Department of Commerce and Industries, Chiragh Ali Lane, Hyderabad 1.
85.	M	1655	Prof. V. V. L. Rao (ET) Principal, Regional Engineering College, Warangal, Central Railway.
86.	AM	8590	K. C. Reddy (M) C.E.'s Office, N.S. Canals, Vijayapuri North, Nalgonda District.
87.	AM	8684	K. S. Reddy (M) Inspector of Factories, Rockdale, Somajigunda, Hyderabad.
88.	AM	3609	B. T. Revathi (M) Executive Engineer, Electrical, Transformer Erection Division, Chapal Road, Hyderabad.
89.	AM	4040	A. S. Sarma (E) Chartered Engineer, 1-8-338 Chikkadpalli, Hyderabad.
90.	AM	4779	B. A. Sarma (C) Executive Engineer, P.W.D., Nellore South Division, Nellore.
91.	AM	4077	J. B. Sastry (C) Chartered Engineer, P.O. Gandhigram, Visakhapatnam.
92.	AM	8591	A. Satyanarayana (C) Executive Engineer, P.W.D. Godavari Western Division, Nidadavole, West Godavari District.
93.	AM	6176	M. Satyanarayan (E) Resident Engineer, Crompton Engineering Co. (Madras) Ltd., Post Box No. 97, Vijayawada.
94.	AM.	8101	H. S. Seshagirirao (MM) Chartered Engineer, 3-6-614, Himayatnagar, Hyderabad.
95.	M	2183	E. Seshagirirao Naidu (C) Superintending Engineer, Singareni Collieries Co. Ltd., Bellampalli, Central Railway.

96.	M	1530	C. Seshavataram (C) Retired Chief Engineer, P.W.D., Ganganmahal Cooperative Colony, Hyderabad.
97.	AM	3893	E. Shanker Rao (E) Executive Engineer (Gas Turbo Sets), 6-3-898/899 Samajiguda, Hyderabad 4.
98.	AM	10034	V. Singappa (C) Assistant Professor of Civil Engineering, Engineering College, Anantapur.
99.	AM	4072	T. K. Sitaramayya (M) Chief Inspector of Boilers, Government of Andhra Pradesh, Behind Employment Exchange, Khairatabad, Hyderabad.
100.	AM	6227	R. Sitaramaraju (E) Deputy Chief Engineer, A.P. Electricity Board, Opposite Bella Vista, Khairatabad, Hyderabad.
101.	AM	5574	M. Sivaramaiah (C) Executive Engineer, P.W.D., M.I.P. Survey Division No. 2, Warangal, Central Railway.
102.	AM	3234	M. R. Sripadarao (C) Chartered Engineer, Soudamani, Waltair.
103.	AM	9574	V. R. Sriram (C) Assistant Civil Engineer, Hindustan Shipyard (P) Ltd., Gandhigram, Visakhapatnam 5.
104.	AM	5823	K. Subba Rao (PH) Superintending Engineer, Special Public Health Circle, Visakhapatnam.
105.	AM	7355	K. V. Subba Rao (M) Executive Engineer, P.W.D., Krishna Central Division, Vijayawada.
106.	AM	5350	N. Subba Rao (C) Chartered Engineer, Anandtirth Agraharam, Guntur.
107.	AM	5871	B. Satyanarayana (C) Superintending Engineer, P.W.D., Guntur.
108.	AM	6657	P. L. Subrahmanyam (C) Divisional Engineer, Highways, Investigation Division, Kakinada.
109.	M	2946	M .V. Suryaprakasam (PH) Superintending Engineer, Public Health, Guntur.
110.	AM	7512	J. D. Talati (M) Divisional Engineer, Tandur Collieries, Bellampalli, Central Railway.
111.	AM	6292	S. M. Tekur (M) Workshop Superintendent, Regional Engineering College, Warangal, Central Railway.
112.	AM	1724	Md. Usman (C) Retired Chief Engineer (Highways), P.W.D., Ameerpet, Hyderabad.
113.	AM	7828	S. K. Varma (E) Power House Engineer, Sirpur Paper Mills Ltd., Sirpur, Kagaznagar.
114.	AM	5694	B. K. Veerabhadra Rao (M) Executive Engineer, P.W.D., Bharati Hospital, 18/2 Arundulpet, Kovvur, East Godavari District.
115.	AM	9323	T. Venkatacharyulu (C) Assistant Professor of Civil Engineering, Regional Engineering College, Warangal, Central Railway.

116. M 1891 G. Venkataraman (E)
Senior Electrical Engineer, Singareni Collieries Co. Ltd., P.O. Kothagudium, *via* Bhadrachalam Road, Central Railway.

117. AM 9694 B. Venkatarama Reddy (C)
Executive Engineer, P.W.D. Flood Control Division, Eluru, District West Godavari.

118. AM 9225 N. S. Venkateswar Rao (E)
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120. AM 9645 T. Venugopalarao (M)
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123. AM 5589 Vithal Rao (C)
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Assam Centre

1. M 1186 H. P. Barua (C)
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2. AM 3823 S. K. Bhattacherjee (C)
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3. M 2305 S. P. Chaudhury (C)
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4. M 2067 K. C. Das (M)
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5. M 1896 Prof. N. Das Gupta (C)
Principal, Assam Engineering College, Gauhati.

6. M 1424 Prof. P. C. Dutt (E)
Principal, Jorhat Engineering College, Jorhat.

7. M 1363 G. Dutta (C)
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8. M 1668 H. B. Gupta (E)
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9. M 2017 G. C. Goswami (M)
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10. M 2339 K. L. Mazumdar (C)
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11. AM 2054 N. S. Nagpaul (E)
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12. M 1915 S. C. Pal (C)
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13. M 1744 M. R. Brahman (C)
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14. M 2424 P. Sharma (C)
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15. M 2121 Prof. R. J. Thaker (M)
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12. AM 3170 S. N. Basak (C)
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13. AM 3322 A. Basu (C)
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14. AM 2853 A. K. Basu (C)
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15. M 2192 S. Basu (M)
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16. M 1254 Capt. B. N. Bhaduri (C)
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17. AM 9274 A. S. Bhatiani (C)
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18. AM 2893 S. S. Bhattacharjee (C)
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21. AM 4025 P. N. Bhattacharya (M)
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23. AM 7705 Dinabandhu Bhattacharyya (E)
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29. AM 8761 A. Bose (M)
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30. M 1320 A. N. Bose (C)
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31. AM 4526 D. K. Bose (C)
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36. AM 5875 P. C. Chakrabarti (C)
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37. AM 4265 N. N. Chakrabarti (E)
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39. AM 7568 Kalharan Chakravarti (E)
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40. M 1511 R. Chakravarty (C)
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43. AM 7290 Dr. B. C. Chanda (CH)
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53.	AM	8270	N. N. Chopra (C) Superintending Engineer (Civil), Durgapur Steel Project, P.O. Durgapur 3, District Burdwan.
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55.	AM	1183	D. Das (M) Mechanical Engineer, 110 Upper Circular Road, Calcutta 9.
56.	AM	5153	Girindra Nath Das (M) 40 Babu Bagan Lane, Dhakuria, Calcutta 31.
57.	AM	2817	P. K. Das (C) c/o Jessop & Co. Ltd., 63 Netaji Subhas Road, Calcutta 1.
58.	M	2628	S. K. Das (E) c/o. Principal, Jadavpur Polytechnic, Calcutta 32
59.	AM	8310	Asoke Kumar Das Gupta (M) 27 Lansdowne Terrace, Calcutta 26
60.	M	1438	J. Datt (C) Regional Engineer, The Concrete Association of India, 9 Brabourne Road, Calcutta 1.
61.	M	2273	S. Datta (C) P-572 Scheme, XL VII, Lake Terrace Extension, Calcutta 29.
62.	AM	6145	K. R. Deb (C) P-388 Keyatola Lane, Calcutta 29.
63.	M	1177	D. S. Desai (C) Director, M. N. Dastur & Co. (P) Ltd., 65 Jatin Das Road, Calcutta 29.
64.	AM	2654	B. Dutta (E) Superintending Engineer, West Bengal State Electricity Board, 183 Panchanantala Road, Howrah.
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66.	AM	4497	N. Dutt (C) 5 Romanath Mazumder Street, Calcutta 9.
67.	AM	4112	D. P. Gangully (E) Plot No. 809, Block P, New Alipore, Calcutta 33.
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69.	AM	5562	N. C. Ganguly (M) Plant Engineer, Durgapur Project, P.O. Durgapur Coke Oven, Durgapur.
70.	AM	4627	H. N. Ghosal (M) Works Manager, Indian Oxygen Ltd., 1/24 Rupchand Mukherjee Lane, Calcutta 25.
71.	M	2199	S. K. Ghose (M) 74/4 Chakraberia Road North, Calcutta 20.
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73.	AM	5655	P. K. Ghosh (E) Divisional Engineer, West Bengal State Electricity Board, 80A Beltala Road, Calcutta 26.
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75.	M	2403	S. Ghosh (M) Chief Inspector & Secretary, Smoke Nuisances Commission, Government of West Bengal, 60B Chowringhee Road, Calcutta 20.
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85.	M	1459	T. R. Gupta (M) 1 Ballygunj Park Road, Calcutta 19.
86.	AM	8689	Dhruba Kumar Haldar (M) 23 Pathakpara Road, Calcutta 34.
87.	AM	7272	Ajit Kumar Hazra (M) Didhithi, 5/4/4A Dum Dum Road, Calcutta 30.
88.	AM	7196	Raghunath Sahai Jain (C) A.P.W. Circle, Port Blair, Andaman.
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30. AM 10666 Arjun Rohtagi (C)
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32. M 1902 V. Y. Kamat (E)
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33. M 859 B. P. Kapadia (C)
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Poona Centre

1.	AM	2026	P. S. Abhyankar (C) Walchand College of Engineering, Sangli.
2.	M	2234	B. P. Agarwal (M) Chief Engineer, Maharashtra Sugar Mills Ltd., P.O. Tilaknagar, District Ahemdnagar.
3.	AM	2470	G. M. Apte (C) 40/27 Bhonde Colony, Karve Road, Poona 2
4.	AM	1437	V. R. Bhinge (C) Engineer & Contractor, Plot No. 8, Mira Road, Sangli.
5.	AM	5325	Lt. Col. J. V. P. Braganza (M) 14 Kahun Road, Poona 1.
6.	M	2388	B. D. Chaudhary (E) Principal, College of Engineering, Karad, District Satara.
7.	AM	9750	Dr. S. H. Chippalkatti (M) 395 Yevalekar Wada, Sambhave Road, Gaoubhag, Sangli.
8.	M	1726	R. S. Deshpande (PH) 433/6 Saraswat Colony, Poona 2.
9.	M	2020	M. M. Doshi (C) General Managar, Cooper Engineering Ltd., Satara Road.
10.	AM	7605	D. S. Dravid (M) Deputy Engineer, 1243/4 Shivaji Nagar, Poona 4.
11.	AM	6195	V. R. Dwarkanath (C) Principal, Government Polytechnic, Kolhapur.
12.	AM	3496	V. S. Godbole (C) Goka Engineering Co., Bhandarkar Institute Road, Poona 4.
13.	M	2346	G. T. Gokhale (C) 'Nirbhaya', 1961 Sadashivpeth, Poona 2.
14.	AM	2995	M. H. Gunda (M) Head of Mechanical Engineering Department, College of Engineering, Poona.
15.	M	2278	Brig. S. B. Jambusarwalla (M) H.Q., Southern Command, Poona 1.
16.	AM	4697	Col. R. Janardhanam (M) Armament Research Development Establishment, Kirkee, Poona 3

17. M 1632 D. V. Joglekar (C)
263/4A Jal Sakti, Near Ramakrishna Ashram, Poona 9.

18 AM 2009 M .V. Joglekar (C)
Consulting Engineer & Designer, 1311 Shivaji Nagar, Poona 5.

19. AM 4030 V. V. Kale (C)
Executive Engineer, Stores Division, Koyna Project, Karad, District Satara.

20. AM 4781 B. S. Kapre (C)
Executive Engineer, Designs Division No. 11, Koyna Project, P.O. Karad Patna, District Satra.

21. M 1003 R. B. Karandikar (C)
26 Deccan Gymkhana Colony, Poona 4.

22. AM 4546 N. D. Karbhase (C)
936/1 North Sadar Bazar, Sholapur.

23. M 1696 M. G. Karmakar (C)
1233/D Rao Bahadur Apte Road, Poona 4

24. M 1155 S. L. Kirloskar (M)
'Lakaki', Poona 5.

25. AM 10383 G. Krishnaswamy Rao (M)
Assistant Director, Research & Development Establishment (Engineers), Dighi, Poona 15.

26. AM 4656 P. T. Kulkarni (E)
'Swapana', 44 Vijayanagar Colony, Poona 2.

27. AM 2491 B. L. Mandke (M)
Kirloskar Oil Engines Ltd., Elphinstone Road, Kirkee, Poona 3.

28. M 1473 G. K. Manolikar (C)
33/3 Erandavane, Poona 4.

29. AM 1318 H. K. Master (C)
4 Ardesher Bagh, Ardesher Irani Road, Poona 2.

30. M 1614 A. G. Maydeo (C)
767/13 Shivajinagar, Poona 4

31. AM 6467 V. G. Mehandaley (CH)
631/26 Sadashivpeth, Poona 2.

32. AM 1781 G. P. Nagarkar (C)
Engineering College, Aurangabad.

33. M 2160 Dr. N. S. Nandeeswaraiya (M)
Professor of Mechanical Engineering, College of Military Engineering, Kirkee, Poona 3.

34. AM 1616 S. K. Neurgaonkar (PH)
141 Kasbapeth, Poona 2.

35. AM 3949 K. M. Patil (M)
Deputy Director of Technical Education, Ghola Road, Poona 5.

36. AM 11892 Om Parkash (E)
Lecturer, I.N.S. Shivaji, Lonavla.

37. AM 5041 K. Ramchander Rao (C)
Superintending Engineer, Amrabati (B & R) Circle, P.O. Amrabati Camp.

38. AM 8415 R. T. Ranade (C)
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39. M 2181 Prof. B. N. Sanyal (C)
Professor of Civil Engineering, College of Military Engineering, Kirkee, Poona 3.

40. M 964 B. R. Sardesai (C)
917/27 Ganeshwadi, Poona 4.

41. M 2783 Prof. M. G. Shah (C)
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42. AM 7791 T. N Srivastava (M)
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43. AM 4974 G. H. Sujan (M)
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44. AM 5991 M. S. Tambe (MM)
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45. AM 6430 R. S. Tilwalli (E)
Walchand College of Engineering, Sangli.

46. M 2797 D. V. Virkar (E)
94 Shukrawarpeth, Poona 2.

47. M 2401 S. E. Wadia (C)
Magdala Cottage, 15 Bund Garden Road, Poona 1.

Punjab Centre

1 M 2636 Balkishen (E)
Superintending Engineer, Patiala Circle, Punjab State Electricity Board, Patiala.

2. AM 10276 P. P. Singh Basur (C)
11 The Mall, Patiala.

3. M 1759 R. C. Bhandari (E)
Head of Electrical Engineering Department, Guru Nanak Engineering College, Ludhiana.

4 M 1646 O. P. Bhasin (E)
General Superintendent, Fertilizer Corporation of India Ltd., Naya Nangal, District Hoshiarpur.

5. AM 5820 Lt. Col. Gurbaksh Singh Brar (C)
Engineer, Commander Works Engineers, Ferozepore Cantonment

6. M 1673 R. N. Chona (E)
15C Sector 9A, Chandigarh

7. M 1892 Har Gobind Dewan (C)
Chief Engineer, North, Punjab State Electricity Board, Patiala.

8. AM 8462 A. R. Garg (C)
Principal, Thapar Polytechnic, Patiala.

9. AM 1508 R. M. Hemnani (PH)
5774, Model Town, Jullundur City.

10. M 2326 Dr. M. L. Jain (E)
Prof. and Head of Electrical Engineering Department, Thapar Institute of Engineering & Tehnology, Patiala.

11.	M	2062	Jatindra Singh (C) Chief Engineer (Projects) Irrigation Works Punjab, Chandigarh.
12.	M	2012	N. R. Junnarkar (M) 173 Adarshnagar, Jullundur.
13.	AM	4545	K. L. Kapoor (C) Executive Engineer, Jullundur Provincial Division, Jullundur Cantonment.
14.	AM	9612	Om Parkash Kapur (C) Executive Engineer, Rohtak Construction Division, PWD, B & R, Rohtak.
15.	M	2071	Madan Lal (C) Director, Central Design, Irrigation Works, Chandigarh.
16.	M	2805	H. C. Malhotra (C) Superintending Engineer (Reorganisation) B & R Civil Secretariat, Chandigarh
17.	AM	8781	Ram Ditta Mal Malik (C) Executive Engineer, Power House Designs, Officers Hostel, Nangal Township, District Hoshiarpur.
18.	M	2691	I. N. Mehta (C) Superintending Engineer, Public Health Engineer, Patiala.
19	M	1689	V. S. Mittal (E) Chief Electrical Engineer, Municipal Power House, Amritsar
20.	M	2900	S. K. Mitra (M) Engineer-in-Charge, Water Works & Drainage, Simla Municipality, Simla
21.	M	2292	P. K. Mukheriee (C) Jt. Director (B & S) R.D.S.O. Ministry of Railways, U.S. Club, Simla 1.
22.	M	2406	Nand Kishore (C) Hargolal & Sons, Hargolal Road, Ambala Cantonment.
23.	AM	3032	M. M. Patel (C) Additional Chief Engineer, Himachal Pradesh P.W.D., Bilaspur
24.	AM	2709	Pratap Singh (E) Director, Central Water & Power Commission, Cleremont, The Mall, Simla.
25.	AM	7537	Kuldip Singh Prem (C) Senior Designs Engineer (C), Hydel Designs Directorate, Sector 18B, Chandigarh.
26.	M	2621	P. S. Sagoo (C) 28/6-J Sector 7, Chandigarh.
27.	M	2633	H. C. Sahgal (E) Superintending Engineer (Project) Punjab State Electricity Board, 6B Baradari Gardens, Patiala
28.	AM	3694	D. R. Singal (PH) Superintending Engineer, Public Health Circle, The Mall, Patiala
29.	M	2163	Prof. Swami Sharan (E) Professor & Head Electrical Engineering Department, Punjab Engineering College, Chandigarh.
30.	M	2490	Dr. Harbans Lal Uppal (C) Director, Irrigation & Power Research Institute, Amritsar

Rajasthan Centre

1.	M	2357	R. M. Advani (C)	Head of Civil Engg. Deptt, Malaviya Regional Engineering College, Gandhinagar, Jaipur.
2.	M	2356	S. K. Agrawal (C)	Principal, Bikaner Polytechnic, Bikaner
3.	M	1777	K. N. Bhargava (C)	Chief Engineer, Health, Jaipur.
4.	AM	11350	R. Bhadada (MM)	Reader in Mining Engineering, M.B.M. Engineering College, Jodhpur.
5	M	2959	J. Das (M)	Chartered Engineer (Ex-Work Manager, Jaipur Metals and Electricals Ltd., Jaipur) 1012/5VJ Rasta Kotewala, Jaipur City.
6.	M	2819	N. H. Desai (M)	Chief Engineer, Cement Factory, Jaipur Udyog Ltd., Sawai-Madhopur.
7.	M	2497	T. M. Desai (M)	10 Dhuleswar Gardens, Sardar Patel Marg, Jaipur.
8.	M	1213	V. G. Garde (C)	Principal, Malaviya Regional Engineering College, Gandhinagar, Jaipur.
9.	AM	5051	S. N. Goel (C)	Principal, Jodhpur Polytechnic, Jodhpur.
10.	AM	8550	G. R. Hukmani (E)	Chief Engineer, Man Industrial Corporation Ltd., Jaipur.
11.	AM	5527	B. K. Jain (C)	Principal, Alwar Polytechnic, Alwar.
12.	M	1683	Prof. V. Lakshminarayanan (M)	Principal, Birla College of Engineering, Pilani.
13.	M	1270	Dr. D. R. Malhotra (MM)	White House, Golf Course Road, Ajmer.
14.	M	2354	R. L. Malhotra (C)	Superintending Engineer (Irrigation), Udaipur Circle. Udaipur.
15.	M	2709	B. D. Mathur (C)	Chief Engineer, P.W.D. (B & R), Jaipur.
16.	AM	2548	J. L. Mathur (C)	Superintending Engineer, P.W.D. (B & R), Udaipur.
17.	M	1412	K. L. Mathur (C)	K23 Malviya Marg, C Scheme, Jaipur.
18.	M	2654	A. S. Mehta (E)	19 Govind Marg. Swami Mansing Highway, Jaipur.
19.	M	2723	D. P. Rastogi (C)	Superintending Engineer, P.W.D. (B & R), 2 Civil Lines, Kotah.
20.	AM	4890	G. S. Sastry (C)	Executive Engineer (Designs) Rajasthan Canal Project, Jaipur.
21.	M	2331	Bhagat Das Satsangi (E)	Principal, Engineering College, J 28 Subhas Marg, C Scheme, Jaipur.

22.	M	2663	K. C. Satsangi (E)	34, Power House Road, Jaipur.
23.	AM	2581	K. N. Sharma (C)	Superintending Engineer, P.W.D. (B & R), Bikaner Circle, Rajasthan.

Uttar Pradesh Centre

1.	M	1256	B. K. Agarwal (C)	Lawrence Terrace, Outram Road, Lucknow.
2.	M	2041	G. K. Agarwal (C)	Principal, Motilal Nehru College of Engineering, 30 Jawharlal Nehru Road, Allahabad.
3.	M	2158	K. M. Agarwal (C)	Consulting Engineer, 307/7 Thapernagar, Meerut.
4.	M	1455	L. N. Agarwal (C)	Retired Deputy Chief Engineer, Old City Bazar, Etawah.
5.	M	1626	L. S. Agrawal (C)	44 Model Houses, Lucknow 6.
6.	M	2736	R. M. Agrawala (C)	Project Engineer, Heavy Electricals (India) Ltd., Hardwar.
7.	M	1515	Z. Ansari (C)	Principal, College of Engineering, Aligarh University, Aligarh.
8.	M	2817	D. Ganesh Athalye (E)	Resident Engineer, The Mirzapur Electric Co. Ltd., Mirzapur.
9.	M	1618	A. P. Bagchi (C)	Superintending Engineer, Bagchi Bhavan, Agra.
10.	M	1349	C. C. Bagchi (C)	Chartered Engineer, C-1053/1054 Mahanagar, Lucknow.
11.	M	1833	N. J. Balani (E)	Works Manager, Hindusthan Aluminium Corporation Ltd., P.O. Renukoot, Mirzapur.
12.	M	1980	Lt-Col. D. N. K. Banerjee (M)	68, Rajpur Road, Dehra Dun.
13.	M	2620	P. K. Banerji (C)	Superintending Engineer, Border Works Circle, P.W.D., Uttarkashi
14.	M	1451	Banwari Lal (C)	Superintending Engineer Retired, 1, Nehru Road, Kutchary, Meerut.
15.	M	2642	Hemanta Kumar Basu (M)	Training Officer, Oil & Natural Gas Commission, Tel Bhawan, 193/16 Civil Lines, Bareilly.
16.	M	2256	P. S. Bhatnagar (C)	Additional Chief Engineer, Public Works Department, Lucknow.
17.	M	2314	B. M. Bhatt (E)	Chief Engineer, Swadeshi Cotton Mills Co. Ltd., Block A-1, Kanpur.
18.	M	2775	M. M. Bhattacharya (M)	Principal, Hewett Polytechnic, Mahanagar, Lucknow 6.
19.	M	504	M. C. Bijawat (C)	Pro-Vice-Chancellor, Banaras Hindu University, Varanasi.
20.	M	2189	G. D. Bishnoi (M)	Chief Inspector of Factories, 7/160 Swarupnagar, Kanpur.
21.	M	1785	V. Cadambe (M)	713B Mahanagar, Lucknow.

22. M 1360 C. C. Chakravarti (M)
Professor and Head of Mechanical Engineering Department, Engineering College, Banaras Hindu University, Varanasi 5.

23. M 2806 S. K. Charan (C)
Superintending Engineer, VI Circle, P.W.D., Gorakhpur.

24. M 2754 A. C. Chaturvedi (PH)
Superintending Engineer, Public Health, Antibiotics Project, Rishikesh, Dehra Dun.

25. M 2493 Prof. R. S. Chaturvedi (C)
Professor and Head of Civil Engineering Department, University of Roorkee, Roorkee.

26. M 1525 U. L. Chaturvedi (C)
Professor Design (Civil), Water Resources Development Training Centre, Roorkee University, Roorkee.

27. M 2232 S. R. Chowdhury (C)
Superintending Engineer, Tube Well Circle, Moradabad.

28. M 687 Chhuttan Lal (C)
Retired Chief Engineer, 'Saket', Eucalyptus Road, Dehra Dun.

29. M 1358 P. B. Das (C)
107 Tagore Town, Allahabad.

30. M 2609 Lt.-Col. M. M. Datta (C)
Deputy Director Photogrammetry, Northern Directorate, Survey of India, Dehra Dun.

31. M 2495 Dines Mohan (C)
Director, Central Building Research Institute, Roorkee.

32. M 2407 R. Dutt (C)
Director, Central Design Directorate, Canal Colony, Lucknow.

33. M 2726 R. S. Gahlowt (C)
Chief Project Engineer, Heavy Electrical (India) Ltd., Hardwar.

34. M 1479 S. S. Gairola (C)
Head of the Department of Civil & Municipal Engineering, Banaras Hindu University, Varanasi.

35. M 2825 Col. T. K. Ganesh (M)
Commandant No. 1, Base Workshop, Allahabad.

36. M 2890 S. P. Garg (C)
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37. M 2179 Lt.-Col. D. K. Ghose (C)
A-8/6 Lokmanyanagar, Near Paper Mill, Lucknow.

38. M 2790 H. H. P. Ghose (PH)
Superintending Engineer, IV Circle, L.S.G.E.D., Bareilly.

39. M 1287 N. N. Ghosh Dastidar (E)
Officer's Flat D, Railway Testing and Research Centre, P.O. Singarnagar, Lucknow.

40. M 1893 Lt.-Col. A. C. Gossain (E)
c/o Mayadass Shivram Dass Gossain, Brassware Merchant, Bhatti Street, Moradabad.

41. M 2498 Lt.-Col. B. Goswami (M)
509 Army Base Workshop, E.M.E., Agra Cantonment.

42. M 1676 B. D. Goyal (C)
Director, Refresher Course, University of Roorkee, Roorkee.

43. M 1457 H. R. Gupta (C)
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44. M 780 K. C. Gupta (E)
Bungalow No. C-2 Hindal Co. Administration Colony, Renukoot, Mirzapur.

45. M 793 M. C. Gupta (C)
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46. M 2263 O P. Gupta (C)
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47. M 1201 P. L. Gupta (C)
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48. M 2744 S. N. Gupta (C)
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49. M 2788 A. N. Harkauli (C)
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50. M 1589 Jagdish Prasad (C)
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51. M 2092 Dr. Jai Krishna (C)
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52. M 1566 J. P. Jain (C)
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53. M 2677 O. P. Jain (C)
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54. M 1916 S. K. Jain (C)
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55. M 1044 D. N. Jayakar (C)
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56. M 2159 H. C. Kaushal (C)
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57. M 1112 A. H. Khan (M)
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58. M 1156 D. C. Khanna (C)
Director, Rural Housing Wing, University of Roorkee, Roorkee.

59. M 2664 Lt.-Col. K. L. Khosla (C)
Deputy Director, Geodetic and Research Branch, Survey of India, Dehra Dun

60. M 1962 Maj. R. K. Kochhar (C)
Superintending Engineer, 2nd Circle, P.W.D., Agra.

61. M 2794 Krishna Chander (C)
Deputy Chief Engineer (Construction), N. E. Railway, Gorakhpur.

62. M 870 K. B. Lal (C)
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63. M 2774 Mahabir Prasad (C)
City Engineer, Municipal Corporation, Lucknow.

64. M 2034 D. D. Majumdar (M)
Director, Small Industries Service Institute, Ministry of Commerce & Industry, 107 Industrial Estate, Kalpi Road, Kanpur.

65. M 2418 N. J. Masani (C)
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66. M 2066 A. C. Mathur (C)
Additional Secretary to Government, 5 Clay Square, Lucknow.

67. M 1491 B. S. Mathur (C)
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68. M 2448 K. C. Mathur (C)
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69. M 1195 K. C. Mazumdar (C)
15A Sarojini Naidu Marg, Allahabad 1.

70. M 2100 M. A. Mirza (C)
Deputy Chief Engineer, Public Works Department, Lucknow.

71. M 1952 K. N. Misra (C)
15 A. P. Sen Road, Lucknow.

72. M 2787 S. N. Misra (PH)
Superintending Engineer, 1 Circle, L.S.G.E.D., Meerut.

73. M 1987 J. P. Mital (C)
Chief Engineer (East), Irrigation Department, Lucknow.

74. M 1253 A. C. Mitra (C)
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75. M 1110 J. N. Mitra (C)
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76. M 783 A. C. Mukerjee (C)
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77. M 1984 Musaddi Lal (C)
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78. M 2587 Col. S. K. S. Mudallier (C)
Director, Survey of India, Dehra Dun.

79. M 2193 G. C. Mukerji (E)
Maris Road, Aligarh.

80. M 2724 K. E. Nayar (C)
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81. M 1476 G. Pande (C)
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82. M 1982 V. P. Pandey (C)
Reader in Civil Engineering, Engineering College, Banaras Hindu University, Varanasi.

83. M 1979 R. S. Pathak (M)
Chief Engineer, The New Victoria Mills Ltd., Kanpur.

84. M 2076 Radhey Shiam (C)
Principal, Madan Mohan Malviya Engineering College, Gorakhpur.

85. M 2486 G. S. Ramaswamy (C)
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86. M 850 Romesh Chandra (C)
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87. M 2440 D. H. Ramachandra Rao (C)
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88. M 2599 T. A. Rao (C)
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89. M 1210 D. P. Rohatgi (C)
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90. M 2482 A. K. Roy (C)
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91. M 2166 N. C. Saha (E)
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92. M 1144 D. N. Sanyal (C)
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93. M 812 M. G. Sardana (C)
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95. M 1102 M. Sen Gupta (E)
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96. M 2737 V. D. Seth (E)
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97. M 2699 I. M. Shah (M)
Deputy Technical Manager and Chief Engineer, L.R.C. Mills, Kalpi Road, Kanpur.

98. M 2494 P. B. Shahani (C)
Reader in Civil Engineering, University of Roorkee, Roorkee.

99. M 2342 B. P. Sharma (C)
Superintending Engineer, Gandak Canal Circle, Gorakhpur.

100. M 2613 R. K. Sharma (E)
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101. M 1369 S. S. Sharma (C)
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102. M 2315 Shobha Ram (C)
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103. M 956 Balbir Singh (C)
Retired Chief Engineer, Irrigation Department, 'Anand', Civil Marg, Allahabad

104. M 1138 B. M. Singh (M)
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105. M 2773 Bhanu Pratap Singh (E)
Chief Engineer, Balrampur Raj Electric Supply Co. Ltd., Balrampur, Gonda.

106. M 1036 Man Singh (C)
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107. M 2492 S. Ram Singh (M)
108/42, Premnagar, Dayal Bagh, Agra.

108. M 2316 S. N. Singh (E)
Chief Engineer, Mathura Electric Supply Co. Ltd., Mathura.

109. M 1691 S. R. Singh (C)
Rector, University of Roorkee, Roorkee.

110. M 2219 Wg. Comdr. Tara Singh (M)
Chief Technical Officer, Air Force Station, Agra.

111. M 1079 Uttam Singh (C)
Sampat Bhavan, Happy Valley, Mussooree.

112. M 2607 Jamna Narain Sinha (C)
Deputy Surveyor General, Eastern Canal Road, Dehra Dun.

113. M 2385 K. Sinha (C)
City Engineer, Municipal Board, Varanasi.

114. M 1702 Flt. Lt. S. M. S. S. Sinha (M)
Deputy Director of Training, Directorate of Training and Employment, Office Building, Hazratganj, Lucknow.

115. M 1379 S. P. Sinha (E)
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116. M 1957 K. C. Sood (C)
Chief Engineer Construction, Northern Railway, P.O. Chopan, Mirzapur.

117. M 1798 R. C. Sood (C)
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118. M 2382 C. P. Srivastava (M)
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119. M 1983 J. P. Srivastava (C)
Superintending Engineer, II Circle, L.S.G.E.D. 25-B, Cantonment, Varanasi.

120. M 1760 P. N. Srivastava (C)
Deputy Chief Engineer, U.P. Public Works Department, Lucknow.

121. AM 3212 Brig. K. Sundaram (C)
Chief Engineer, Northern Zone, Dilkhusha, Lucknow.

122. M 1362 L. Swarup (C)
Retired Superintending Engineer, P.W.D., 189 Saket, Meerut City.

123. M 2715 Y. Ramchandra Tipnis (C)
Chief Engineer, Indian Institute of Petroleum, 19A Lytton Road, Dehra Dun.

124. M 1766 H. G. Verma (C)
Project Engineer, Antibiotics Project, Rishikesh.

125. M 1280 Dr. J. W. Whitaker (MM)
Director, Indian Institute of Petroleum, 19A Lytton Road, Post Box No. 80, Dehra Dun.

Nepal

1. M 2204 Krishna Murari (C)
Member, Irrigation & Power, Indian Aid Mission, Kathmandu.

NAMES OF SUCCESSFUL CANDIDATES IN THE STUDENTSHIP AND ASSOCIATE MEMBERSHIP EXAMINATIONS HELD IN MAY 1964

The following candidates have been declared to have passed the Studentship and Associate Membership Examinations held in May 1964.

STUDENTSHIP EXAMINATION

Roll	No.	Name of candidate
St.	4	J. T. Ghunakikar
St.	13	M. Gopal
St.	23	S. Arasu
St.	24	U. B. Rao
St.	45	S. Swaminathan
St.	49	S. L. R. Sharma
St.	83	N. R. Reddy
St.	85	A. R. Vanderveen
St.	87	S. Neelakantan
St.	94	G. Seetharaman
St.	113	N. S. Sarma
St.	117	Talla Satyanarayana Reddy
St.	122	E. K. Ramachandran
St.	165	Gurmukh Singh
St.	183	R. Balasubramanian
St.	194	D. P. Keshri
St.	201	D. V. Gangadhar
St.	214	A. S. Kini
St.	217	Kewal Krishan Puri
St.	222	Sunderrajan Murali
St.	284	S. N. Mishra
St.	285	Lakshmi Narayan Misra
St.	287	M. Vijayanunni
St.	288	A. K. Guha Thakurta
St.	291	M. C. Sen Gupta
St.	293	R. K. Gupta
St.	297	S. Dutt
St.	300	V. D. Jaiswal
St.	309	D. H. Vishin
St.	312	Samar Kumar Mukherjee
St.	317	D. Mishra
St.	321	T. R. Sharma
St.	328	O. P. Sharma
St.	331	Prem Kishore Taneja
St.	333	Sada Nand
St.	335	J. C. Malhotra
St.	339	B. K. Dass
St.	342	N. K. Thakur
St.	347	Harbans Lal Singla
St.	350	G. M. Ajwani
St.	351	R. L. Verma
St.	358	A. K. Mazumdar
St.	359	Darshan Singh
St.	367	S. V. Devesh
St.	370	Y. P. Sachdeva
St.	377	Vijey Kumar Parmar
St.	378	Kundan Lal
St.	384	K. B. K. Sharma
St.	389	H. S. Mauji
St.	390	Y. P. Bhatia
St.	393	Melu Singh Dhingra
St.	401	George P. Abraham
St.	408	K. K. S. Nair
St.	416	G. D. Guder
St.	426	P. S. R. Sastry
St.	438	B. Subrahmanyam
St.	459	Y. K. Kurty
St.	463	K. G. Reddy
St.	467	V. Dharmareddy
St.	486	N. R. Rao
St.	495	B. S. Sastry
St.	503	Shanti Swaroop
St.	507	U. Joshi
St.	509	H. C. Malviya
St.	511	Vasudeo Verma
St.	520	N. J. Trivedi
St.	524	P. H. Dhanwani
St.	525	M. L. Sharma
St.	528	Shugan Lal Vaish
St.	543	R. K. Parchure
St.	545	Goru Devalingam
St.	546	N. D. Subramanian
St.	559	S. N. Garg
St.	566	Naresh Kumar
St.	579	M. L. Kanda
St.	587	R. K. Sharma
St.	589	D. C. Beri
St.	591	Chandra Prakash
St.	594	S. Singhore
St.	604	N. K. Saggi

STUDENTSHIP EXAMINATION—*contd.*

Roll	No.	Name of candidates	Roll	No.	Name of candidates
St.	610	Om Krishan Wahie	St.	849	S. R. Rao
St.	617	Kundan Singh Thapa	St.	855	C. S. Rao
St.	635	T. P. Kurian	St.	878	B. H. G. K. Murty
St.	649	D. Kamath	St.	883	B. V. Sharma
St.	654	S. Subbiah	St.	885	Raj Kumar Aggarwal
St.	678	P. Elangovan	St.	886	G. S. Gill
St.	685	A. G. Thobhani	St.	891	Krishan Kumar Gupta
St.	688	V. Narayanan	St.	895	Dayanand Malik
St.	689	G. R. Iyer	St.	923	Dev Raj Sharma
St.	691	B. V. Sundararajan	St.	927	Shanti Sarup Dhir
St.	694	Adachira Neleri Premaraj	St.	932	Mehar Chand Adlakha
St.	701	T. R. Nandabalan	St.	944	Ramadhar Ram
St.	709	S. P. Balasubrahmanyam	St.	947	Shubh Narain Singh
St.	724	S. Dhanaraj	St.	954	Ram Naresh Mishra
St.	726	R. Balajirao	St.	968	V. P. Kukade
St.	728	U. S. Sivaram	St.	969	S. V. Shejwalkar
St.	736	C. S. Vamanan	St.	971	C. F. D. Lima
St.	737	V. Parasuraman	St.	977	S. H. Jahagirdar
St.	742	K. Venkateswaran	St.	998	M. G. Rajulu
St.	770	V. Padmanabhan	St.	1005	C. K. Kuriakose
St.	771	T. K. M. Ram	St.	1010	Khazan Singh Yadav
St.	791	R. Narayanasamy	St.	1012	Samarendra Kumar Palit
St.	810	M. Veerappan	St.	1022	O. P. Chawala
St.	819	P. M. Ramana Babu	St.	1041	N. Gopinathen Pillai
St.	820	S. K. Swaminathan	St.	1047	K. G. Rajappan
St.	823	P. Syamasundaran	St.	1064	K. W. Anto
St.	826	Rajamanickam Ramanatha	St.	1074	K. N. P. Nayar
St.	842	P. N. Balaraman	St.	1079	J. V. Rao
St.	847	K. S. Rao	St.	1108	Pradeep Bahree

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A

(Existing Scheme)

Roll	No.	Name of candidate	Roll	No.	Name of candidate
	1A	Jaydev Ramprasad Desai		79A	B. M. Subramaniam
	4A	K. N. Sanjanwala		83A	S. R. Sripad
	5A	K. P. Bulchandani		85A	Raghupathy Naidu
	19A	Kanwar Singh Ahluwalia		89A	R. Ranga Raju
	36A	Lalit Kishore Trivedi		93A	Mallaiah
	37A	Veerappa Venkatasamy		94A	S. V. J. Rao
	38A	Chinubhai Manilal Pandya		95A	H. R. Hanumantha Rao
	56A	H. D. Srinidhi		96A	Bhaskara Rao Nanduri
	57A	Sukhedv Lal Singh Bajaj		110A	G. A. Lakshminarayana Setty
	60A	T. R. Venkatesan		117A	Gopal Tejbhandas Chhabria
	63A	Basireddy Chenchi Reddy		131A	Tonse Mohammad Saheb
	64A	N. P. Sangireddy		133A	S. R. Prahalada Rao

ASSOCIATE MEMBERSHIP EXAMINATION SECTION A—*contd.*

Roll No.	Name of candidates
138A	K. L. Narasimham
148A	K. Vittaldas Joishy
150A	K. Loganathan
157A	S. Kalyana Sundaram
158A	P. Neelaiah
159A	Krishna Rao Nagaraja
161A	D. S. Gangadhara Rao
185A	Kallu Ram Rajpal
195A	Ramesh Narayan Ghatge
224A	B. Lingoosa Srinivasa
229A	T. Mallikarjunan
231A	Riaz Ahamad Shariff
238A	Allam Ganiraju
239A	Kuchibhatla Harinarayana
242A	Surapaneni Venkata Rao
245A	Basu China Chalamaiah
249A	R. K. Govardhan
255A	Srinivasa Harigopal
259A	T. Channakesavelu
260A	Kumuriti Anjaneyalu
285A	D. K. B. Jamadagni
289A	V. V. Jagannatha
299A	Surinder Paul Maggu
325A	Manharlal Mehta
327A	Lal Awatrai Dadlani
344A	S. Surya Prakash Naidu
346A	Hiranmoy Chatterjee
349A	Y. J. Sethumadhava Char
350A	Nanhe Lal Jain
352A	Tapan Kumar Barat
367A	Khem Chand Shishodia
368A	Charanjit Singh Girgla
371A	S. C. Mehta
384A	K. P. Ravindra Nath
386A	Balakrishna Rao Kundeje
392A	Daya Ram Verma
400A	J. D. Chandnani
406A	Ashok Baburao Shinde
407A	S. D. Kulkarni
408A	Bishamber Lal
411A	G. D. Ram
415A	Indrajit Singh
419A	P. Damodaran Nair
426A	B. R. Datar
427A	Chandrakant Date
428A	K. P. Jaukhedkar
429A	Ved Prakash Kamra
430A	Roop Kumar
432A	Govind Santumal Kewlani
433A	Mahendra Pal
434A	Hajari Lal Kosta
435A	C. V. Subramanian
437A	Bansi Lal Chawla
439A	Yog Raj Kalra
440A	S. Jagannatha Rao
445A	Rajendra Prasad
446A	Pramod Kumar
448A	K. Prabhakar
452A	Chanan Singh Jaswal
455A	J. S. S. Sagoo
459A	Hari Shanker Misra
460A	N. P. Shrivastava
463A	Vinod Kumar Srivastava
465A	V. Y. Rao Salunke
473A	Zora Singh Sohi
483A	Amar Singh Gill
486A	Harihara Veeramani
488A	Jugal Kishore Srivastava
489A	Girija Nandan Sharma
490A	Mahendra Mohan Johri
491A	Gyanesh Prasad Rai
496A	Kewal Chand Mittal
504A	Nil Ratan Paul
510A	Sushil Kumar Kapoor
515A	Brahma Dev Agrawal
517A	Chander Mohan Chawla
525A	Rishindra Nath Rath
527A	Balbir Singh Saini
528A	Vijay Kumar
529A	Rajinder Nath Leekha
530A	P. Chandra Sekhara Rao
533A	Raj Kumar Kambo
537A	B. K. Shrivastava
539A	J. Malleswara Rao
545A	B. K. Murthy Setty
547A	Parmanand Goel
555A	S. N. Matai
560A	Prabhat Kumar Pande
564A	Sunder Lal Bhatla
567A	Satya Prakash Srivastava

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
568A	Baldeo Krishana Ghaiye
577A	Dharam Das Gurnani
580A	Prem Kumar Bhatia
587A	Jai Kishan Goel
591A	Mangaldas Nathulal Mehta
602A	Ramakant M. Agrawal
607A	T. Chandrasekharan
608A	Satish Kumar Gupta
613A	M. P. Vegad
620A	Homi Piroshaw Karani
622A	M. D. Punjabi
627A	P. K. Keralavarma Raja
628A	R. Ananthasankara Iyer
629A	Kumud Ranjan Datta
632A	B. G. Marathe
633A	A. R. Masani
634A	Krishna Kautik Chaudhari
637A	Prabir Datta
638A	P. K. Chatterjee
639A	P. Nadarajan
641A	Ansari Moiz Ishaquebhai
654A	K. V. Subbarao
664A	S. K. Banatwala
667A	N. R. Balasubramanian
670A	Ashokchandra B. Shah
671A	Satya Mitter Handa
672A	K. K. Vasu
683A	Arun Bhalchandra Phadke
684A	Suhas Gangadhar Bhagwat
688A	M. S. Krishna Murthy
689A	Ramachandra Bhat
690A	T. S. Viswanathan
691A	A. V. Balakrishnan Nambiar
694A	M. D. Solanki
698A	Sitaramaiyer Venkataraman
701A	S. T. Chaudhari
702A	A. S. Manelkar
706A	Vinod Kumar
707A	R. N. Tirthali
718A	Ronald Francis Fernandez
730A	Dhirubhai Bavabhai Patel
731A	Mukund Nagesh Joshi
735A	Parmanand Virumal Balani
772A	S. V. Thakar
782A	R. S. Keshkar
791A	Chandra Kanto Ghosh
798A	K. Venkateswarlu
804A	C. D. Kamai
806A	P. C. Das
830A	Jagdish Pragji Desai
852A	S. M. Mohammedali
865A	Suresh Krishna Deshpande
886A	Dipak Ghoshal
887A	Tushar Ranjan Sen
890A	Mukul Ranjan Saha
891A	Kalyan Kumar Halder
892A	Priya Bondhu Chowdhury
893A	Shiv Kumar Chopra
895A	Bijoy Kumar Bhattacharjee
901A	A. K. Banga
902A	S. C. Bhatia
906A	Jyotirmoy Chatterjee
909A	Diptis Chandra Goswami
911A	T. K. Chatterjee
912A	K. Bhattacharyya
913A	Sushil Kumar Chakraborty
919A	M. V. Krishna Rao
921A	Sivprasad Bhattacharyya
927A	Amlan Kumar Dutta
928A	Bansibadan Saha
929A	S. R. Banerjee
930A	Asoke Kumar Roy
932A	Ratan Prakash
933A	Bansi Mohan Garyali
934A	Hare Krishna Mazumdar
937A	Narayan Bhattacharyya
949A	Subodh Chandra Das
950A	Bidhu Bhushan Singh
957A	Bandan Kumar Ghosal
959A	Gour Sankar Das Sarma
960A	A. N Roy
964A	Arabinda Sekhar Mukherjee
965A	Niharendu Banerjee
967A	Manoj Kumar Laskar
968A	Anadi Nath Bhattacharyya
969A	Asit Kumar Nag
970A	N. K. Kundu
971A	Niranjan Deb
973A	Jayanta Kumar Basu
974A	Sadhan Chandra Bhaumik

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
978A	Basudeo Prasad Ray
988A	Utpal Kumar Mukherji
989A	B. N. Roy Choudhury
992A	A. R. Mrithyunjayan
1003A	Mrinal Kanti Chowdhuri
1004A	Seetharama Subramanian
1009A	Venkatesan Lakshapathy
1011A	Hara Nath Mukherjee
1015A	Pinaki Prosad Mukherjee
1016A	Debprosad Sanyal
1024A	Tapan Kumar Mukherjee
1026A	Dipak Kumar Sarkar
1028A	Dilip Kumar Chakrabarty
1032A	Gopinath Guin
1039A	Ajit Kumar Patra
1042A	Biswa Ranjan Bera
1045A	S. S. Bagchi
1049A	Arun Kumar Basu
1052A	Paritosh Bhattacharyya
1054A	Panchu Gopal Sarcar
1057A	Narajit Kumar De
1059A	Suryyasen Kanjilal Roy
1061A	Radha Kanta Saha
1062A	Rabindra Nath Ray
1066A	Jyoti Bikash Bose
1070A	Bishnu Charan Chatterjee
1073A	R. K. Malhotra
1075A	Vedurumudi Kameswar Rao
1083A	D. N. Chattopadhyay
1085A	R. N. Chakraborty
1090A	Bimalendu Ghosh
1092A	Dilip Kumar Das
1099A	Ramapada Bhadra
1101A	Biswanath De
1102A	Samir Kumar Roy
1108A	Satya Priya Das
1109A	S. K. Malhotra
1110A	Timir Kanti Bhattacharya
1111A	Amiya Sankar Majumder
1115A	Ranjit Kumar Ray
1119A	Ranjit Kumar Chatterjee
1121A	Saroj Kumar Sengupta
1124A	Gour Gopal Das
1127A	Ajoy Roy
1129A	Nirmalchandra Mukherjee
1131A	Atindra Nath Pal
1140A	Gouri Sankar Das
1143A	Ranjan Roy Chowdhury
1151A	Ravindra Kumar Deb Roy
1155A	Bijan Kumar Nath
1156A	Ranju Gopal Deb
1160A	Dipak Kumar Ray
1163A	Kshirod Prosad Mohanty
1164A	Ranjit Chatterjee
1165A	Manik Lal Chaudhuri
1176A	Subinoy Sarkar
1179A	Dulal Chandra Samanta
1180A	Rabindra Nath Ghosh
1184A	Ranajit Kumar Mohapatra
1186A	T. K. Sarkar
1190A	Kamala Kinkar Sen Gupta
1191A	Krishna Mohan Sharma
1197A	Bijoy Krishna Charui
1203A	Shubhendu Sen Gupta
1205A	Ribhu Sen
1206A	Bijayendra Kumar Datta
1208A	Sibasadhan Rakshit
1213A	Ram Babu Sharma
1220A	D. P. Agrawal
1223A	Sugata Sarkar
1242A	Yugal Kishore Singh
1244A	R. K. Bhagatt
1246A	Sunil Kumar Chattopadhyay
1250A	Syamal Kumar Banerjee
1262A	Tapan Kumar Bhattacharyya
1268A	Kiranmay Lahiri
1270A	Dhirendra Nath Banerjee
1280A	Mukul Chandra Das
1289A	P. K. Chakraborty
1298A	Debabrata Chakraborti
1302A	Asok Kumar Sen
1306A	B. G. Roy
1309A	Jagat Narayan Datta
1310A	Barun Kanti Gupta
1311A	Sukumar Chatterjee
1314A	Susil Kumar Biswas
1315A	Sudhansu Kumar Dutt
1316A	Bhulu Ranjan Saha
1321A	Narendra Nath Srivastva
1333A	Asok Sengupta

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidates
1351A	Debabrata Mukhopadhyay
1362A	Anjani Kumar Sinha
1363A	Pranab Kumar Mukheriee
1368A	Tapan Kumar Ghosh
1372A	Shiba Brata Mitra
1395A	Santosh Kumar Podder
1402A	Sankar Prasad Ghosh
1407A	B. C. Srivastava
1410A	Naresh Chandra Kundu
1415A	Narayan Chandra Basak
1427A	Rabinarayan Mohanty
1428A	Avimanyu Patnaik
1436A	Robindro Kumar Adhikari
1437A	Achyutananda Pattanayak
1438A	Rajendra Kumar Ghose
1445A	Nagendranath Swain
1449A	Madhusudan Biswal
1452A	Ranajit Roy Chudamani
1453A	Dhanurdhar Mishra
1454A	Gobardhan Dora
1457A	Gourishyam Mohanty
1461A	Krupasindhu Nanda
1472A	Karunanidhi Sahu
1473A	J. P. Singh
1475A	D. Ganapathi Rao
1484A	Gurbachan Lall
1495A	Prem Parkash
1496A	Sushil Kumar Awasthy
1498A	G. A. Hingoiani
1499A	Moti Lal Uttamchandani
1503A	Naresh Chandra
1504A	Jagmohan Lal
1506A	Sudesh Kumar Chawla
1509A	Darshan Singh Bhatia
1510A	Mahinder Lal Kohli
1511A	Jaswant Ram Sharma
1512A	Makhan Singh
1513A	Hasmat Rai Puri
1519A	Anand Swarup Gupta
1523A	Vishan Das Jogiani
1524A	Chandur Bhatia
1530A	G Lal
1531A	Dev Raj Kukreja
1536A	B. K. Dadlani
1537A	Kunwar Bahadur Jain
1542A	Roshan Lal Aggarwal
1544A	Krishan Kanaya Madan
1545A	K. Lal Kapur
1548A	Bansi Lal Chugh
1558A	Prem Sagar Nagia
1562A	Madan Lal Bali
1565A	Prem Kumar Bhatla
1572A	Harbans Lal
1581A	Shanti Sarup Dhir
1591A	Sant Lal
1592A	Joginder Singh Rahi
1593A	K. K. Bulchandani
1594A	Hari Bijlani
1595A	Nand Lal
1596A	Madan Lal Deda
1598A	Jai Bhagwan
1602A	Dharam Vir
1603A	Subhash Chand Jain
1604A	Ram Bhaj Garg
1606A	Sham Singh Blah
1608A	Mange Singh Verma
1610A	Sant Lal Mendirata
1612A	Puran Mal
1621A	Jagan Nath Arora
1628A	Shri Gopal Gupta
1629A	Laxmi Chand Gupta
1631A	Ram Krishna Gupta
1634A	H. R. Gupta
1638A	Sita Ram
1641A	R. K. Jain
1643A	C. P. Katyal
1644A	Murari Lal Sharma
1645A	Krishan Kumar Wahi
1648A	Raghbir Singh Baidwan
1649A	Raj Mohan Singh
1651A	M. M. G. Giri Rao
1672A	Shiv Kumar Gauba
1675A	Onkar Nath Anand
1678A	Mahendra Singh
1680A	Harijaspal Singh Hora
1684A	Jotinder Singh Jolly
1686A	Sohan Singh Sandhu
1690A	Rajeshwar Kumar Gupta
1695A	Jai Narain Goel
1696A	Partap Chand Mathur

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidates
1700A	Ram Kumar Gupta
1704A	K. K. Bhatia
1713A	R. K. Sharma
1717A	Om Parkash
1718A	Rajinder Kumar Anand
1719A	Sudarshan Kumar Bhandari
1725A	Kewal Krishan Bassi
1730A	Anand Parkash
1737A	Madan Lal Dua
1742A	Ghanshyam Lal Mittal
1744A	Jagdish Parkash Bhuchar
1747A	Ved Kumar Juneja
1748A	Jai Dev
1755A	Jaspal Singh Saini
1762A	Dharam Chand
1763A	Govardhan Lal Dua
1768A	Ghanshiam Mohan Saxena
1769A	Jitendra Kumar Mathur
1771A	Krishan Kumar Gupta
1777A	Ram Krishan Sharma
1780A	Narinder Nath Kakkar
1784A	Wazir Chand
1791A	Bishamber Lal
1792A	Brij Mohan
1797A	S. P. S. Ahluwalia
1816A	Madan Pal Pundir
1817A	Baldev Kumar
1822A	T. P. Sharama
1825A	Om Parkash Kalra
1829A	Kasturi Lal Sahni
1840A	Baldev Singh Jolly
1843A	B. K. Sharma
1847A	Surendra Kumar Gupta
1850A	Ram Prakash
1857A	Swami Parshad Malhotra
1860A	Sudarshan Kumar Vasisht
1862A	M. Gurtar Singh Sidhu
1863A	Ranjit Singh Chima
1870A	Rajinder Kumar Sharma
1873A	Manmohan Singh Chibber
1878A	Inder Mohan Goswami
1895A	Bhisham Pitama Shukla
1902A	Rajeshwar Prasad Gupta
1910A	Surinder Mohan Sachdeva
1922A	Prem Singh Sarpal
1924A	Himadri Kumar Sadhu
1932A	Bijay Krishna Dutta
1936A	Bishnu Pada Sen
1937A	Asit Kumar Dhar
1950A	Ganesh Chandra Ghosh
1951A	Kisori Mohan Poddar
1954A	Ardhendu Sekhar Niyogi
1955A	Mihir Kumar Ray
1957A	A. V. Rangarajan
1972A	Kesheo Gopal Deo
1976A	Tushar Kanti Chakrabarty
1988A	Lekh Raj Dua
1991A	Radha Shyam Pal
1995A	Siri Krishan Shukla
1996A	Sukhendu Ghosh
2000A	Jitendra Nath
2008A	Yash Dev Sarin
2012A	K. Venkatakrishnan
2020A	S. Sethuraman
2026A	Charan Jit Singh
2030A	Subbarao Nagraja Rao
2034A	B. P. Shah
2046A	Birendra Prasad Mandal
2047A	Shri Krishna Swarn Kar
2049A	Modalavalasa Ranga Rao
2052A	Y. K. Murthy
2061A	Thuramalla Narasing Rao
2070A	G. Sree Ramachandra Murthy
2072A	T. Chendrasekhara Rao
2076A	N. Venkatramulu
2078A	M. Nageswararao
2081A	Suri Subrahmanya Sastry
2082A	Shaik Meera Saheb
2085A	V. V. S. S. N. Murty
2089A	Jayanti Satyanarayana
2090A	Balkrishna N. Huparikar
2095A	Sreepada Ramakrishnamurty
2096A	C. V. Rao
2100A	Mutyala Venkataraju
2101A	Vuyyuru Kata Reddy
2105A	P. S. Sahasranaman
2112A	Ghanta Venkata Rami Reddy
2118A	Garimella Subrahmanyam
2123A	A. Suryanarayana Murty
2125A	G. G. Kulkarni

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate	Roll No.	Name of candidate
2132A	Lankala Shakher Reddy	2373A	Om Parkash Bindra
2137A	K. Surayanarayana Murthy	2380A	Inasu Jose Maliakkel
2143A	Jagdish Chander Gulati	2391A	Hari Pershad Mathur
2150A	C. Ramaiyer Viswanathan	2400A	Vijay Narain Saharia
2172A	Yalala Subba Rao	2406A	Narain Kalumal Nandwani
2174A	Vutukuri Koteswara Rao	2424A	D. Krishan
2178A	P. Nancharaiah	2426A	Gopal Balkrishan Kulkarni
2179A	R. Radha Krishna	2427A	Sheo Prasad Rai
2180A	Vasamsetti Bharatudu	2428A	Teja Singh
2183A	Buddi Dasaradharamayya	2431A	Bivash Chandra Pramanik
2188A	Mocherla Nataraj	2432A	R. Krishnan
2189A	Kothapalli Madhava Rao	2438A	Bindeshwari Prasad Gupta
2191A	Kurre Sambi Reddy	2440A	Rangachari Devanathan
2195A	P. G. Moorthy	2446A	Ram Sarup Verma
2199A	Umakant Joshi	2448A	T. V. Subba Rao
2200A	Vedula Jayarama Murty	2450A	Ramchandra Prasad Bakshi
2207A	N. C. Roy	2457A	C. S. Sivaramakrishnan
2214A	Ram Sarup Bagga	2463A	Tadimety Krishna Murty
2220A	Chandra Kant Verma	2470A	Raj Kishore Mishra
2222A	Kandikuppa Sankara Rao	2471A	Ram Nandan Prasad
2223A	D. K. Roy	2476A	Jagannath T. Gopal
2224A	Chandra Prakash Bhargava	2477A	Ramchandra Jayaraman
2225A	T. L. Satija	2484A	Krishan Kumar Suri
2233A	Chandra Prakash Dixit	2495A	Jas Raj
2236A	Sheo Prasad Pandey	2497A	S. K. Salwan
2240A	Pooran Chandra Khare	2503A	Kailash Vallabh Vyas
2251A	K. R. Seshadri	2508A	Pukh Raj Bora
2261A	Bishamber Singh	2529A	Shyam Sunder Nath Mehta
2262A	Ram Singh	2530A	Hiro K. Dhankani
2264A	Jasbir Singh Sidhu	2532A	Govind Chand Mathur
2265A	Mahendra Kumar Dikshit	2535A	Jagdish Chander Dave
2271A	Om Prakash Harkut	2536A	P. S. Talesra
2274A	Om Prakash Sharma	2537A	Ranchhor Das Rathi
2275A	Raj Kumar Bhatia	2542A	Jagjit Singh
2282A	Subash Chander Malhotra	2543A	Surinder Nath Maini
2297A	Baljit Singh Yadava	2550A	Dharampal Singh Premi
2301A	Jagdish Chander Wadhwa	2554A	Gurmail Singh Sandhu
2310A	Narain Roop Mathur	2560A	Surinder Mohan Yadav
2325A	Ram Chandra Agarwal	2565A	Prem Pal Kochhar
2327A	Kailash Narayan Tanwar	2571A	Joginder Kumar Bakshi
2344A	Choith Sitaldas Merani	2572A	Jasbir Singh
2345A	Virendra Singh Verma	2573A	Surinder Mohan Kapoor
2346A	Gurbachan Singh Dhaliwal	2574A	Inder Mohan Khosla
2364A	Goverdhan Lal Vyas	2584A	Kapur Chand Bansal
2365A	Rajmal Jain	2601A	Narinder Singh Gulati

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
2602A	Subhas Chander
2610A	Santosh Kumar Saini
2613A	Jasmer Singh
2616A	Jugal Kishore Jairath
2622A	J. S. Grewal
2629A	Prithvi Raj Johar
2642A	Surendra Nath Srivastava
2646A	Chandra Pal Sharma
2651A	Prem Sagar Beotra
2652A	Nand Lal Kataria
2653A	Uma Shanker Sharma
2655A	Giriraj Kishore Gupta
2671A	Shyam Saran Lal Sinha
2673A	B. M. Goyal
2676A	Mahinder Nath Mehtani
2677A	Ravi Nandan Agarwal
2678A	Jaswant Singh Reyat
2684A	Surendra Singh Saluja
2686A	Gur Prasad
2694A	Jagdish Kapoor
2696A	K. B. Srivastava
2698A	Om Prakash
2699A	V. B. Singh
2701A	Yoginder Paul
2705A	Nand Kishore Pandey
2706A	Adbhut Narain Misra
2710A	Abdul Qayum
2716A	B. Kishore
2726A	Raghuvansh Kumar Tandon
2727A	Satya Van Sharma
2731A	Om Parkash Narang
2732A	N. R. S. Rangan
2734A	Naresh Chandra Srivastava
2743A	Narayan Dev Tripathi
2747A	A. K. Shukla
2748A	Vishwambhar Dayal
2755A	P. G. Agwekar
2757A	Prem Kumar
2764A	Viswamitra Kapoor
2772A	Kamla Kishore Pandey
2774A	Surendra Singh
2778A	P. D. Mahajan
2779A	Satischandra Misra
2782A	Jaldhari Singh Kushwah
2786A	Bhagwan Dass
2791A	Satish Kumar Madan
2803A	Ram Nath
2804A	Cherukuri Gangadhara Rao
2805A	Om Parkash Kumar
2808A	Ved Parkash Katyal
2819A	Dayal Singh
2832A	Ram Raksh Pal
2844A	Balbir Singh Sodhi
2848A	S. K. Singhal
2859A	Santosh Chander Verma
2861A	Charanjit Lal Narula
2862A	Mahendra Prakash Garg
2865A	Pawan Kumar Thukral
2869A	Raghuraj Singh Chauhan
2870A	Virendra Behari
2875A	Sushil Chandra
2903A	Brij Raj Saran Srivastava
2910A	Shankar Lal
2917A	V. Sundararajan
2920A	S. Narasimhan
2921A	J. M. J. Samuel
2923A	K. V. Bala Ram Rao
2927A	S. Raghava Chari
2928A	R. Lakshminarayanan
2929A	K. S. Srinivasan
2930A	T. G. Purushothaman
2936A	T. Shanmugakani
2937A	A. Savarimuthu
2938A	S. C. Perumal
2939A	Dandapani Dalai
2941A	A. Sivasankaran
2944A	K. Mahadevan
2945A	K. Sethuganesan
2950A	Godithi Veeraraghavulu
2954A	B. Ramachandran
2956A	R. Sundaran
2957A	Gokulananda Mishra
2964A	Jacob John
2965A	Sundaresan Sadasivan
2968A	Muthuswamier Sethuraman
2969A	Radha Krishna Namburi
2973A	N. S. Srinivasan
2975A	V. Hariharan
2976A	Mohammed Musa
2984A	M. K. Mohiddin

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidates
2987A	D. V. Ramana Rao
3001A	Syed Abdul Hadi
3008A	Eddula Linga Reddy
3009A	T. Ganesan
3012A	T. M. Raghunathan
3013A	Palvannathever Ramalingam
3016A	James Ratnaraj
3026A	V. Harihara Iyer
3029A	Veeraputran Ganesan
3031A	D. Rengarajan
3041A	P. V. Narayanan
3051A	V. R. Rajamanickam
3053A	P. Anantharama Bhat
3063A	Bhagavatula Venkatappaiah
3066A	V. Sriramulu
3071A	Srinivasa Ramanujam
3072A	Seetala Narayana Rao
3095A	K. S. Balasubramanian
3113A	K. S. Subbian
3116A	G. S. Kailasam
3117A	A. Balasubramanian
3132A	V. Lakshmanan
3133A	Krishnaiyer Ramachandran
3153A	Merla Hanuma Reddy
3155A	T. R. Pachamuthu
3165A	Kandukuri Gangaraju
3175A	P. S. Viswanathan
3180A	C. T. Wazalwar
3186A	Gaya Prasad Misra
3197A	G. Ramachandran
3198A	V. H. Motdhare
3205A	Mahendra Singh
3207A	Ajit Kumar Sen
3208A	Dharm Paul Singh Lamba
3210A	D. D. Ambhorkar
3213A	Purushottam Rajaram Mande
3217A	Kaleeswara Subramanian
3219A	M. P. Netke
3238A	A. R. R. M. Rau
3240A	Ganesh Datt Sharma
3241A	Ved Parkash Gupta
3244A	Jagdish Lal Goswami
3245A	Mangat Rai Singal
3259A	Kharaiti Lal Tandon
3261A	Tarlochan Singh Sethi
3264A	Brij Bhushan Tangri
3269A	S. Singh Gill
3270A	Devinder Singh Chaudhry
3271A	Kuldip Singh
3273A	Ramesh Chand Bansal
3274A	Prem Mohan Manchanda
3279A	Shiv Raj Kumar Aggarwal
3284A	Harish Chandra Minocha
3286A	Hari Prakash Misra
3298A	Ved Prakash
3300A	Balbir Singh Sandhu
3301A	Rupinder Pal Singh
3302A	Mohan Lal Bansal
3314A	Inderjit Ohri
3317A	Anil Kumar Bhargava
3319A	Madan Mohan Sharma
3323A	Paritosh Kumar Neogi
3332A	B. S. Sindhu
3348A	Krishan Gopal
3354A	Hanuman Singh
3362A	Jasmel Singh
3374A	Sudesh Kumar Anand
3376A	Joginder Pal Gupta
3383A	Narain Dutt Sharma
3385A	Des Raj Sethi
3394A	Satish Chandra Vohra
3407A	Devinder Singh Saini
3412A	Gopal Krishan Bhatia
3414A	Sudarshan Kumar Soni
3425A	Triloki Nath
3427A	Anand Swarup Garg
3433A	Raj Kishore Narain Yadav
3434A	Shailendra Kumar Ojha
3438A	Niharendu Sarkar
3441A	Gouri Shankar Samanta
3453A	Purnendu Kumar Paul
3455A	S. N. Jha
3457A	Lalji Sahai Srivastava
3462A	Satya Narain Sharma
3465A	Tahauwor Hussain
3466A	Lakshman Lall Baranwal
3471A	Subodh Kant Roy
3472A	Rameshwar Sinha
3475A	Triloki Nath Sharma
3479A	Sadho Pandey

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION—A—*contd.*

Roll No.	Name of candidates
3484A	Aditya Narain Singh
3486A	Parmanand
3514A	Paras Nath Tewari
3517A	Biswa Nath Chatterjee
3539A	Surendra Prasad Mahto
3540A	Ram Lakhan Mishra
3541A	Naresh Prasad Vishwakarma
3549A	S. K. Bandyopadhyay
3561A	Mehboob Abbas Shaikh
3562A	Madhukar Krishnaji Desai
3566A	S. C. Mahajan
3569A	Manohar Dattatraya Chobhe
3574A	Gopal Krishan
3582A	Madhav Moreshwar Deodhar
3588A	Sambhu Chandra Dasgupta
3600A	Prafulla Kumar Pal
3601A	Arvind Dattatraya Chikte
3602A	T. P. S. Narayanan Nair
3609A	D. R. Patil
3615A	Jawahar Sabhani
3619A	Inder Sen Dhawan
3622A	Prakash Hiralal Joshi
3624A	Ajoy Kumar Guha Thakurta
3630A	Ramesh Kumar Bajpai
3652A	K. Ravi Babu
3655A	Ram Anjor Yadav
3715A	L. S. Chaudhari
3722A	Awanindra Nath Jha
3737A	Dinesh Chandra Roy
3756A	R. P. Sinha
3757A	Sunil Kumar Kanjilal
3760A	Narayan Chandra Bhadra
3767A	Mohan Lall
3769A	Raj Kumar Gupta
3773A	Penjmudy Ramachandrarao
3775A	Mitter Sain Kapla
3787A	Tirkha Singh Sheshodia
3788A	A. A. Ansari
3791A	N. C. Mittal
3794A	Syamshunar Guin
3797A	Prem Chand
3818A	Shesh Narain Misra
3820A	H. C. Mittal
3823A	Rajendra Mohan Agarwala
3825A	Pramod Kumar Gupta
3826A	Prem Chandra Jain
3835A	Tirlochan Singh Lamba
3837A	Kalyan Singh
3839A	Kanhaiya Lal Garg
3842A	Nek Ram Sharma
3857A	Rameshwar
3859A	Anand Prakash
3861A	Danvir Singh
3867A	Amar Nath Aggarwal
3869A	Prithi Paul Singh Chugh
3871A	Kewal Krishan Dawar
3874A	Mani Ram Goel
3888A	Narendra Dutt Gupta
3889A	Parshotam Lal Sharma
3898A	Dharam Vir Ajmani
3899A	S. K. Agarwal
3901A	Salek Chandra
3903A	Bhimasenarad Doreswamy
3906A	Manda Rama Narayana Rao
3907A	M. V. Sarma
3908A	Santosh Kumar Chowdhury
3912A	Bhegirathi Padhy
3922A	Lingaraja Paty
3937A	Madan Lal Gupta
3945A	K. M. Punnoose
3949A	Ramakrishna Venkitachalam
3959A	T. H. Subramonia Ayyar
3963A	S. Padmanabhan
3965A	R. P. Mohindra
3967A	R. Gopalakrishna Pillai
3972A	C. Radha Krishnan
3980A	Thomas P. Thomas
3981A	P. N. Gopakumaran Nair
4000A	L. Srinivasan
4007A	S. K. L. Raju
4011A	K. Neethiraj
4019A	P. P. Kumaran Nair
4021A	P. B. Nair
4026A	G. Sadanandam Chetty
4027A	Md. Sheik Peerani Saheb
4037A	T. V. Sanyasi Rao
4065A	L. I. Reddy
4069A	Venkatakrishna Balaraman
4087A	Kalidindi Ramabhadri Raju

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate	Roll No.	Name of candidate
4099A	P. S. Kandaswamy	4111A	G. Radhakrishnan
4100A	S. Appoothy	4119A	M. S. Murthy
4101A	T. C. Palani	4128A	N. S. Unnikrishnan
4102A	Venkatarama Sundararaman	4137A	N. Ghosh
4103A	S. Loganathan	4138A	R. L. Garg

ASSOCIATE MEMBERSHIP EXAMINATION SECTION—B

(Existing Scheme)

Roll No.	Name of candidate	Roll No.	Name of candidates
1B	L. G. Vanjani	136B	Rameshwar Dayal Agrawal
8B	K. B. Raghavendra	139B	Malini Nivritti Bhujbal
15B	Jagdish Lal Satija	142B	S. B. Naik
18B	N. Singlachar	146B	Vijay Kumar Bassi
21B	B. S. Visweswara	147B	Om Parkash Jain
26B	Hosalli Seshadri	149B	Y. D. Dawalbhakata
30B	K. J. Raghunath	156B	K. M. Pillai
31B	P. Gopal	157B	Vijay Balkrishna Agte
33B	Kapulurui Padmanabha Reddy	158B	V. P. Gadgil
37B	Subbaraya	173B	Shridhar Balwant Kulkarni
45B	Madhao Moreshwar Gangal	174B	S. K. Tibrewala
47B	Rajagopala Narayanan	179B	A. Sundaram
51B	G. Nagireddy	197B	H. K. Ramarao
52B	Sujit Kumar Sarker	198B	Satya Paul Nangia
53B	Krishna Kumar Dass	201B	B. Narahari Ramaprasad
54B	P. R. Vedantam	206B	Akhil Bandhu Mukherjee
57B	R. K. Swamy	207B	Prabir Kumar Ghosh
68B	B. S. Ranganath	208B	R. K. Bhattacharjee
86B	V. K. Bukshi	210B	Sarjoo Pandey
90B	Chuhar Lakhanomal Lalwani	212B	S. N. Chakravorty
95B	V. K. Gupta	216B	Chitta Ranjan Paul
98B	Arigapudi Venkataratnam	218B	Samar Kumar Bhattacharya
101B	Gurcharan Singh	221B	P. K. Ganguly
105B	Bhim Sain Nakra	232B	Syed Abdul Alim
109B	P. R. Sen Sarma	234B	Sunil Kumar Rudra
113B	T. V. Venkateswaran	241B	Anil Kumar Pal
114B	P. V. Nair	243B	N. C. Mukhopadhya
116B	G. K. Ganesan	245B	Soumendra Chakraborty
118B	M. N. Ramachandran	246B	Anil Ranjan Ghosh
120B	Annaji Vasudev Dongarkar	247B	Biswanath Palbag
121B	Surrender Pal	249B	Ranjit Kumar Roy
122B	Kishin Balchand Varandani	254B	Arun Kumar Datta
127B	M. J. Parikh	256B	Dasarathi Karmakar
129B	Y. R. Khadilkar	257B	B. N. Maulik
131B	N. K. Gharat	259B	Arun Kumar Basu
133B	K. W. Tharani	261B	Sukumar Mitra

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidates	Roll No.	Name of candidate
264B	Mihir Kumar Sinha	384B	Swedesh Kumar Kapur
265B	Prasanta Kumar Ghosh	386B	Gian Chand
272B	Asoke Kumar Mukhopadhyay	388B	Rangaswami Vasudevan
273B	M. M. Mukhopadhyay	389B	Shanti Kumar Khanna
275B	Nirmal Kumar Sinha	390B	Surjit Singh Grewal
278B	Samir Kumar De	391B	Virendra Prasad
280B	Kalyan Kumar Roy	394B	Virendra Singh Garg
283B	Sukumar Sarkar	399B	Shri Krishna Sharma
288B	Bhima Charan Mukherjee	404B	Krishna Kumar
296B	Ramasubban Ramachandran	406B	J. N. Kathpalia
303B	Alok Dutta	409B	Gopal Krishan Sawhney
304B	Ranjit Kumar Chakraborty	411B	Harish Chandra Sharma
305B	U. Sankaranarayana	413B	Gopal Das Ranglani
313B	N. Padmanabhan	414B	Surendra Nath Goswami
317B	Debdas Bandyopadhyay	415B	R. K. Gupta
319B	H. L. Khanna	418B	Prem Nath Khanna
323B	Braja Mohan Mohanty	421B	Ved Prakash Chandna
324B	Beant Lal Khanna	423B	Rajeshwar Sahai Saxena
326B	Kailash Chandra Panda	431B	Naranjan Singh Rooprai
328B	B. N. Senapati	432B	Satya Pal
329B	Parikshit Tripathy	434B	Gulshan Rai Jain
330B	Kedar Nath Misra	437B	Rajindar Shankar Mathur
332B	Saheb Prusty	439B	P. C. Gupta
336B	Nakul Sahoo	442B	Om Prakash Wadhwa
337B	N. Gajapati	443B	R. D. Gupta
339B	Purna Chandra Pradhan	444B	K. N. Seshadri
341B	B. S. P. Panda	457B	Samir Kumar Chatterjie
345B	Nakul Chandra Sahoo	459B	Nirmalya Mukherjee
346B	Narendra Nath Mohanty	462B	Havenahalli Satyanarayana
349B	Niranjan Kumar Dash	464B	J. C. Dey
350B	U. R. Rao Patnaik	465B	Jagdish Mitter Narula
355B	Nanda Kishor Satpathy	466B	A. Chakravartty
357B	Bharat Pradhan	469B	Oommen Pulinthitta Thomas
361B	Qimati Lal Dua	470B	K. Subramaniam
364B	Bhupinder Bir Singh	471B	Hari Ram Jaiswal
365B	Jwahar Lal Kukreja	476B	Y. Venugopal Naidu
367B	Om Parkash	477B	Hundi Bindumadhava Rao
368B	R. K. Jain	478B	D. B. Rao
371B	Amarjit Lal Chawla	480B	D. V. Rao
372B	Krishan Lal Sang	485B	Korremula Pandu
376B	Pritpal Singh	487B	B. Sreenivasa Rao
377B	Vijay Kumar Puri	490B	S. S. Sastry
378B	Anand Kunwar Singh Tyagi	491B	Machiraju Pandu Ranga Rao
382B	Shiv Lal Mehan	495B	Cheerala Narayan
383B	Ramesh Chander Chandwani	497B	N. Satyanarayana

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of Candidates	Roll No.	Name of candidates
500B	P. S R. Seshaiah	667B	Rajinder Datt
503B	Vaddi Reddy Rosi Reddy	679B	Kripa Shanker Bajpai
512B	Sunkara Subba Rama Reddy	685B	Ram Bhaj Khurana
519B	Pala Chandra Rao	688B	Chandra Bhushan Mall
521B	Pabbisetty Chenchal Rao	693B	Gurjit Singh Birdi
526B	M. S. Murty	699B	Avinashi Chandra Nagar
532B	Vuppala Sathyanarayana	703B	Mahendra Singh
533B	Vemuri Janardhana Patel	704B	Tulsi Das Ahuja
534B	A. Kaliamoorthi	705B	Suresh Kumar Agarwal
535B	Vepakomma Subba Rao	706B	Bajrangi Rai
540B	B. H. Badarinatha Rao	710B	Girija Shankar Agarwala
543B	Akondi Kameswara Rao	711B	G. S. Kaushik
566B	I. Satyanarayana	719B	Pran Nath Kalra
572B	T. Eswara Reddy	724B	Satya Pal Puri
576B	Kolli Raja Reddy	726B	Tilak Raj Chawla
577B	P. S. Rao	727B	Sachidanand Sahay
580B	Nandipati Veera Reddy	730B	Satish Chander Bakshi
581B	Gorty Hanumannarayana	731B	Naunihal Chandra Jaggi
583B	Y. A. Chenna Reddy	735B	Inder Sain Sehgal
591B	Suniti Kumar Sinha	739B	Subhash Chander Bansal
595B	V. R. Krishnan	745B	T. R. Raghavan
601B	Ram Sahai Sharma	748B	R. Venkataraman
605B	Chander Jaisinghani	751B	J. B. Stephen Jeyaganam
607B	Tilak Raj Banga	752B	V. Nagaswamy Sreenivasan
610B	Ram Gopal Dangayach	756B	G. R. Sarma
612B	S. Bhambhani	758B	V. P. Prasad
613B	Bhanwar Lal Jain	762B	M. Sundararamanujam
614B	Krishan Swarup Garg	763B	V. Kandaswami
616B	Som Prakash Bhatia	768B	V. Venkateswara Rao
619B	Bhim Sain Kathuria	778B	K. N. Subramanian
622B	Haripada Bhattacharyya	780B	S. Rajagopalan
624B	S. S. Saggu	781B	T. V. Sundram
628B	M. P. Venkateswaran	782B	T. A. Balasubramanian
640B	Ram Kumar Gupta	787B	Ayyagari Babu Rao
644B	Manohar Lal Behl	789B	N. Doraiswami
646B	Rajindar Singh	790B	C. K. Rajan
647B	Krishan Kumar Vohra	800B	Venna Adi Rami Reddy
648B	Kuldip Singh Dua	809B	S. Ramachandran
651B	Rajindar Kumar Berry	814B	M. B. Ramamurthy
653B	Chattar Bhuj	815B	K. S. Reddy
654B	Nand Lal	826B	A. K. Vijayayaraghavan
655B	Darshan Singh	830B	Manuel Ebenezer
657B	Gurjant Singh	841B	P. R. Shreenivasa Rao
659B	M. R. Bansal	848B	Dhanraj Bakhatrai Pinjani
662B	Atma Ram Mehra	849B	P. S. Sawhney

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate
850B	M. N. Khadase
852B	Om Prakash Bhatia
856B	Harnek Singh Sohal
857B	Manmohan Singh Rathor
859B	Ramchand Ramrakhiani
860B	S. B. Bhatnagar
862B	Vedantam Sitaramayya
868B	Surinder Singh Mavi
869B	Prem Nath Goyal
872B	Parkash Singh
874B	Gopal Rai
875B	Inderjit Singh Jubble
876B	Pratap Ji Arora
879B	Ajaib Singh Bhardwaj
881B	Hardwari Lal Shahi
882B	Karam Chand Seth
884B	Brahm Datt Aggarwall
886B	S. N. Gupta
888B	S. Singh Bhandal
889B	Gurdial Singh Brar
891B	Swarn Singh Aulakh
901B	R. R. Bhaskar
905B	Somnath Gandhi
914B	G. C. Verma
919B	Vishwanath Shukla
920B	Ram Chandra Prasad Singh
921B	Vishnu Chandra Singhal
927B	Hari Ram
928B	Narayan Prasad Srivastava
929B	Baleshwar Prasad
930B	Om Parkash Batheja
932B	Devendra Prasad Verma
937B	Hari Madhab Bagchi
938B	Roop Kishore Mehrotra
940B	C. S. P. Singh
942B	Vikramditya Singh Sindi
945B	Venigalla Rangarao
946B	Trilok Singh
948B	Gulab Chand
954B	Ganesh Prasad Bhargava
957B	G. G. Abhyankar
963B	A. R. Prasad Reddy
964B	Om Prakash Chadha
965B	Yeshavant Trimbak Joshi
966B	L. V. Parashare
968B	R. S. Deshpande
969B	A. M. Momin
973B	Chandrupatla Bhujanga Rao
974B	Ramakant Bhalchandra Wagh
975B	Madhukar Shankar Patil
978B	A. V. Agashe
980B	S. P. Patwardhan
985B	P. V. Narayanaswamy
986B	V. N. Kundanlal Nanda
987B	A. C. Pillai
994B	Devendra Prasad Singh
995B	Dharma Deo Chaubey
997B	Shyam Lal Gupta
1000B	Nem Chandra Jain
1002B	Yogendra Kumar Gulati
1003B	Tej Pal Singh Verma
1004B	Harkishan Lal Julka
1016B	Bal Krishan Jindal
1018B	S. S. Bansal
1019B	Ram Kumar Singhal
1021B	Sumit Kumar Banerji
1023B	Ishwar Chandra Mittal
1029B	Satish Chandra
1037B	Ram Bharosey Lal Verma
1039B	G. Veerabhadram
1040B	S. B. Mahapatra
1047B	M. N. Venkat Reddy
1048B	Bijaya Kumara Panigrahi
1053B	Som Nath Pandita
1057B	T. R. Narayanan
1058B	S. Vittalan Potti
1060B	P. Jacob Kurian
1064B	P. Somasekharan Nair
1068B	K. Narayana Pillay
1069B	V. K. Ummer
1071B	V. K. G. Nair
1074B	P. Sreekumaranthampy
1078B	John Jacob
1083B	M. Sankara Narayana
1089B	T. Satyanarayana
1090B	Hanumanthu Shivaji Rao
1091B	O. V. John
1092B	Kotha Radha Krishna
1100B	N. Sathyamaiah Setty

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate	Roll No.	Name of candidate
1105B	Vadali Srirama Murty	1121B	D. M. Mohan
1111B	Anupindi Sitaramam	1122B	Ramachandran Govindarajan

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A

(New Scheme)

Roll No.	Name of candidate	Roll No.	Name of candidate
54NA	Memraj Baldas Udasi	1872NA	Surendra Chandra Kalita
57NA	J. Swaminathan	1972NA	N. Arunmuganainar
66NA	K. Kamalaksha Kamath	1976NA	Velpuri Narasimha Rao
67NA	T. V. Gopalan	2016NA	P. V. Vidyadhara Rao
80NA	C. Balasubrahmanya	2027NA	D. Purushotham Reddy
82NA	K. Ramanathan	2118NA	S. D. Gollapudi
107NA	K. S. Desikan	2120NA	V. Krishnama Chary
118NA	M. Thimme Gowda	2363NA	Gurpershad Aggarwa
148NA	Krishna Bhat Polali	2528NA	Hafizur Rahman
163NA	B. Vidyadhara Hegde	2592NA	Avtar Singh Mann
247NA	G. N. Narayan	2926NA	Gur Charan Singh
294NA	H. D. Achyutharao	3044NA	Thiagarajan Ranganathan
297NA	Asadulla Shariff	3053NA	Brundaban Jena
307NA	A. Vishnu Bhat	3059NA	Sahadeb Patra
322NA	K. A. Suryanarayana	3063NA	Harihar Sahu
398NA	R. S. Klair	3164NA	V. Gopinathan Nair
458NA	Venkatraman Raghavan	3165NA	R. Balaraman
462NA	A. B. Dani	3230NA	K. C. Ramachandran
593NA	Prabhakar A. Prabhu	3402NA	Satya Narayan Chaudhuri
629NA	D. R. Naidu	3419NA	R. Subramanian
843NA	A. R. Patwardhan	3421NA	R. Srinivasan
1126NA	Hadibandhu Khandual	3536NA	Surinder Kumar Vijh
1210NA	Sailendra Nath Sanyal	3537NA	Tara Chand Gera
1218NA	Abdul Raquib	3549NA	Om Parkash Bansal
1357NA	B. K. Das	3584NA	Jagdev Singh Kainth
1379NA	Pramoda Chandra Das	3777NA	Ramanugrah Narayan Singh
1380NA	Umesh Chandra Mahanty	3884NA	S. B. Suparekar
1405NA	Kulamani Rath	3886NA	P. A. Vohra
1474NA	V. Kumar	3899NA	S. M. Deo
1489NA	Inder Raj Sardana	3900NA	D. P. Bhardi
1491NA	Hari Dev Sheekri	3914NA	Subhash Chandra Nath
1522NA	Balwant Singh Tomar	3945NA	S. A. Mandekar
1587NA	Krishan Mohan Saxena	3949NA	S. B. Patil
1608NA	Ramesh S. Lachhiramani	3960NA	A. S. Naik
1702NA	Ravinder Kumar Puri	4037NA	T. Guravaiah
1822NA	Panchanan Ray	4129NA	P. S. Malhotra
1829NA	S. C. Acharyya	4281NA	Virendra Kumar
1869NA	Sukumar Ghosh	4284NA	K. Haridas

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
4336NA	Jawahirlal Chrungoo
4400NA	H. Rajagopal
4446NA	S. R. Nair
4449NA	M. A. Antony
4491NA	J. K. Clement
4559NA	Divakarla Srinivasa Rao

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B
(New Scheme)

Roll No.	Name of candidate
	Civil
23NB	E. S. Rao
105NB	N. Mahapatra
106NB	R. N. Rout
107NB	K. C. Dehuri
139NB	J. K. Bhatia
153NB	D. D. K. Chandiramani
173NB	Y. T. Hosmani
174NB	M. N. Purohit
207NB	C. Sarangi
307NB	J. C. Wason
318NB	N. Venkatesan
319NB	B. Srinivasan
320NB	C. A. V. Raman
327NB	V. S. Rajappan
334NB	Y. Venkata Sivudu
358NB	B. L. Katyal
372NB	Dashrath Singh
432NB	G. R. K. Tagore
452NB	G. Simhachalam Naidu
463NB	K. Venkatachalayya
	Mechanical
489NB	S. N. Singh
540NB	S. N. Dutta
574NB	P. S. H. S. Kumar
629NB	R. Narayanan
634NB	S. Srinivasaraghavan
647NB	S. Subramanian
678NB	V. S. Narasimhan
711NB	Satish Kumar Sharma
720NB	Gur Dyal Bakshi
727NB	K. C. N. Nambudiri
	Electrical
746NB	K. Narayana
808NB	Prahlad Palo
815NB	Purshottam Kumar Gupta
845NB	R. M. Garde
850NB	D. Rajagopalan
886NB	U. S. Acharya
890NB	S. M. Loganathan
891NB	H. S. Durgaprasad
921NB	Arvind Kumar
930NB	R. C. Gupta
	Chemical
958NB	Roshan Lal Sharma
961NB	S. Srinivasan
	Metallurgical
969NB	Paritosh Maitra
972NB	Krishan Kumar Malik
979NB	R. C. Mathur
	Electronics & Telecommunication
985NB	M. P. Nagabhushana
987NB	M. N. S. Sastry
990NB	A. R. Maniam
998NB	Sohan Singh Virdi

INSTITUTION NEWS

A report on the Fourteenth Sectional Meeting of the World Power Conference Lausanne, Switzerland

D. P. R. Cassad
Member
Past-President

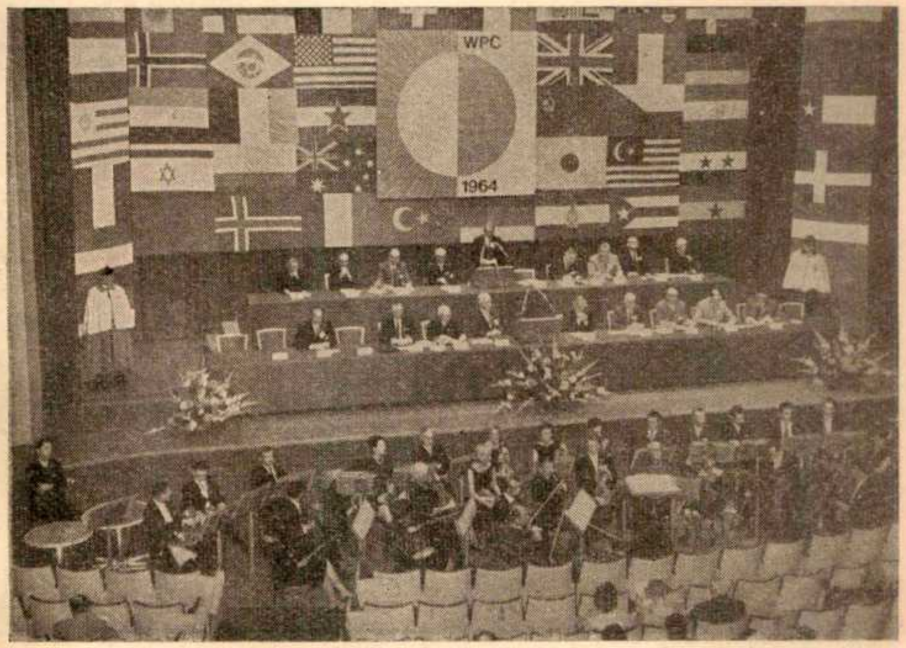
The Institution has continued to act as the Indian National Committee for the World Power Conference from 1924 and has represented India at all Plenary and Sectional Meetings. The Fourteenth Sectional Meeting of the World Power Conference was held at Lausanne, Switzerland, from 13th to 17th September, 1964. A report by Shri D. P. R. Cassad, (M.) a Past-President of the Institution, and a Past-President of the Indian National Committee who attended this Meeting is given here.

The year 1964 could not have been better chosen to hold the Fourteenth Sectiona Meeting of the World Power Conference at Lausanne, the outstanding event being the holding of the Swiss National Exposition, an event which is held only four times in a century. The theme was 'For Switzerland of Tomorrow: Believe and Create', which was elaborated in a vivid presentation of this small country. Lausanne has a population of about 130,000 which is spread over the shores of the Lake of Geneva which has been heralded through the ages by poets and writers. The theme of the subject for the Conference, 'The Struggles for the Prevention of Losses in the Field of Power', was discussed threadbare at the different technical sessions that were held.

The Opening Ceremony of the Sectional Meeting took place in the Theatre of the Palais de Beaulieu at 3.30 p.m., which was inaugurated by the Mayor of Lausanne, Mr. G. A. Chevallaz, with musical interludes by the Chamber Music Society of Lausanne under the direction of Mr. Arpad Gerecz. Greetings for the success of the Conference were offered by E. H. Etienne, President of the Swiss National Committee, P. Oguey, State Senator representing the Vaudois Government, and several other local dignitaries. Responses to the greetings were given by W. H. Connolly of Australia, President of the World Power Conference, Mr. P. Sevette, Director of the U.N. Energy Division of the European Economic Commission, and representatives of the National Committees of Germany, the United States, France, Great Britain and the Union of Socialist Soviet Republics. The Session was officially declared open by Dr. Willy Spuhler, Federal Councillor and Head of the Federal Department of Transportation, Communications and Power, who represented the Government of Switzerland.

Mr. Spuhler, addressing the Conference welcomed the delegates to the Canton of Vaud and the City of Lausanne, and stated that the Swiss Government was aware of the honour of having for the second time this meeting of the World Power Conference. He said that one of the constants of technology and technical thought was the spirit of research which incessantly seeks greater efficiency, alleviation of toil, and decrease of useless efforts.

He said that in view of the new demands made on power economics it was all the more important to define the causes of loss so as to increase the return of power which is utilized. He said that not only technical problems required solution, but each country must define a power policy to balance continually increasing demands with the resources available. He pointed out that in Switzerland their goals were quite plain—power supplied at a reasonable cost, sufficient and sure supply of power to guarantee the independence of the country, and protection of the air and water against pollution.



OPENING CEREMONY OF THE SECTIONAL MEETING AT THE PALAIS DE BEAULIEU

Mr. Etienne, the Chairman of the Swiss National Committee, accorded a cordial welcome to the delegates and the guests.

Mr. Oguey stated that he was happy to meet the technical elite of over 50 nations and the savants and engineers from all the continents who were there to study the importance of world economic problems. He said that research for the best utilization of power was of major concern—discovering new sources of power and optimum utilization was an economic imperative as well as a means of rendering homage to nature.

Mr. Chevallaz stated that the programme of the Conference was reassuring to all of them and they came to this meeting with mixed feelings of respect and fear. He said that the Conference was trying to serve the techniques and interest of the common problems of preventing or reducing economic losses.

Mr. Connolly, President of the World Power Conference, said he was overcome with the warmth of the welcome in such pleasurable circumstances and a picturesque setting.

He said that the subject of the Conference, 'The Struggles Against Losses', was a very important one in the present day affairs of the world and should provide an answer to the question of overall economics. The General Reporter said that losses in the field of power were gigantic and the limits of their reduction were restricted.

Mr. Sevette speaking on behalf of the U.N., stated that the major problems included determination of resources, development of production, transportation and satisfaction of needs for both primary and secondary power. Concerned with these were the Economic and Social Affairs Departments and the four Regional Economic Commissions which covered the Far-East, Latin America, Africa and Europe, including the Soviet Union. Their great interest was evinced in the economic analysis of the situation in each section of power, the essential components and perspectives in the development of exchange of ideas and experiences, and the promotion of international cooperation for the optimum utilization of existing sources of energy. He offered his wholehearted cooperation and the reciprocal interest of both the organisations in the future as well.

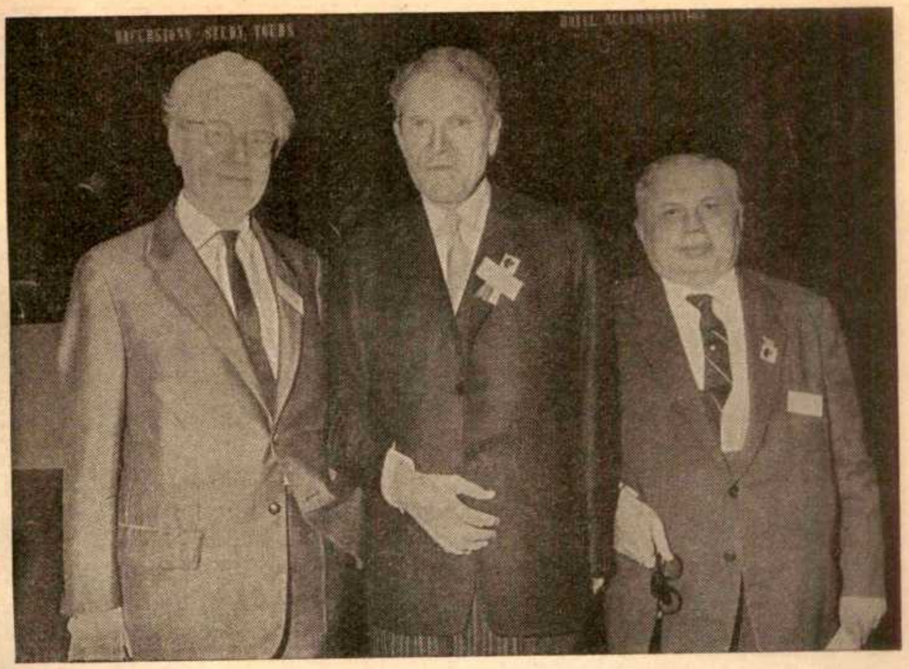
The First General Address entitled 'Combating Losses in the Fields of Space-Heating and Air-Conditioning—The Scientists' Point of View', was given by Dr. H. Reiher, of West Germany. He elaborated his address by elucidating measures to reduce heat losses from buildings, by statements on rational air-conditioning and insulation of the heating plant, and by measures for making the best use of the energy in a fuel and the electrical space age.

The Second General Address was delivered by Mr. M. P. Ailleret and the subject was 'Economical Integration of Nuclear Power Plants'. He stated that it was not merely a problem of place in the load diagram when examining the possibility of integrating nuclear power stations economically in energy production and distribution but many other factors have also to be take into consideration.

Another General Address was delivered by Dipl.-Arch. H. R. Sutter, of Switzerland, on the topic 'Thermal Insulation of Buildings,—the Architect's Points of View'. Dr. Suter stated that he wished to establish that planning and building in a way consistent with heat technology can be realised only to a limited extent. The fight against energy losses represents only one problem among many in the work of an architect. The design of a building or a group of buildings, of housing, whether a town or an estate, is a task having many sides and many different layers—to the architect, it is a combination of problems, which may be sociological, hygienic and organisational, as well as constitutional, structural and economic and all of them must be taken into account.

The Third General Address on the final day of the Session was delivered at the Sectional Meeting of the World Power Conference by Philip Sporn, Chairman, System Development Committee, American Electric Power Co., on the topic 'The Prospects for Further Reduction of Losses in Capital, Fuel, Operation and Maintenance in Advanced Large Fossil Fuel Steam-Electric Power Systems'. Mr. Sporn reviewed the subject matter of his address, and of the progress made so far in the reduction in capital costs and fuel costs, and gave a listed account with regard to the progress maintained in the reduction of operating and maintenance costs.

Several technical papers were submitted to the Sectional Meeting.



Dr. Reiher of germany (*left*) who delivered the First General Address, Mr. Etienne, Chairman of the Swiss National Committee (*centre*), and Shri D. P. R. Cassad (*right*)

The only paper submitted from India to the World Power Conference was by Prof. M. V. Deshpande, entitled 'Combined Operation of Hydro and Thermal Plants', where he examined the methods of calculation in order to determine the programme of utilization of means of production for power plants situated on rivers and lakes and for thermal groups, taking into account the marginal cost and the incidence of transmission. Attention was also drawn to the advantages of pumping stations working in large interconnected groups which allow a more economical method of working of large thermal groups. These pumping stations, being consumers of energy in peak hours, regulate the production of the thermal plants and consequently improve their output.

In Section IIC, one paper was presented entitled 'Present Tendencies for Improving the Efficiency of Nuclear Stations'. The meeting was presided over by Mr. H. West of Great Britain and Shri D. P. R. Cassad as the First Vice-Chairman, with Prof. A. Gardel as the Second Vice-Chairman ; and the General Reporter was Dr. h.c.P.De Haller. In all, 12 papers were submitted in this Section and 18 delegates took part in the discussions

On a paper submitted by Mr. Amin, from Pakistan, Mr. Fremont Felix from the U.S.A. commented that Mr. Amin analyses the cost of energy and arrives at the conclusion 'that despite the low unit output, nuclear energy isthe more economical for certain regions of Pakistan where fossil fuels are expensive. His estimate would appear to be very optimistic for annual charges of 7.2% for interest and amortization. It would be interesting to obtain more details on this subject.'

SHRI CASSAD AND THE REPRESENTATIVES FROM HUNGARY, GREECE AND THE UNITED KINGDOM AT THE MEETING OF THE INTERNAL EXECUTIVE COUNCIL

Mr. Felix believeds that the load growth will be faster than planned for and consequently, the nuclear plant will be operated at the maximum plant factors as fast as permitted, thus further enhancing the favourable economic results to be exected.

In a paper on the same subject, presented at the Geneva Conference just concluded, by M. Yusuf, entitled 'Introduction of Rooppur Nuclear Power Plant in Epwapda Grid', it was indicated that the per capita consumption of electric power in East Pakistan was about 15 kWh in 1963. At that level, Mr. Felix has shown in a paper presented at the American Power Conference in March 1964 (entitled 'Growth of Energy Consumption and National Income Throughout the World') that the world average actually records a rate of increase of 15% per year. At the 35 kWh per capita level which should be reached in approximately 5 years, the rate of growth will still be 13% if it conforms with the world average record, and it will take another 50 years at least before the growth rate in East Pakistan's use of electric energy tapers down to the 7% associated with doubling in 10 years. Thus, in the 5 years which will have elapsed by 1968, when the Rooppur plant is in operation, the present 300 MW generating capacity in East Pakistan will have grown to be between 500 and 600 MW and will again double in the following 6 years—which will be the first six years of operation of the nuclear plant—to approximately 100 MW. Thus, the new Rooppur plant appears to be assured of a high load factor which should further enhance its economic attractiveness from its very first years.

The General Reporter, after summarising the papers in this Section, stated that numerous questions could not be discussed in detail. However, there were a few points deserving special attention. Mr. Gibrat voiced his anxiety as to the guaranteeing of fissile material supplies for future nuclear power stations. He said it would be interesting to hear the opinion of experts as to the necessity of having resources to this form of energy, and on the part it is capable of playing in the overall supply, havig regard to the known reserves of uranium, thorium and fossil fuels.

Since there was nobody from India or the Far East, the Chairman, Mr. West, called upon Shri Cassad to say a few words with regard to the situation in India. Shri Cassad's brief speech is given below.

'I thank you, Mr. Chairman, for this opportunity to say something of the situation in India. You will probably remember that when in 1958, Dr. Bhabha, our atomic power expert, said that atomic power would be able to compete with conventional power in the not very distant future, that statement was greeted with some scepticism. However, you know exactly the situation as it is now. There is no doubt that nuclear energy is going to play a very important part in the future energy demands. In the less developed countries, the question of costs would be of prime importance. It would be interesting at this point to see how the proportion of nuclear to conventional power is expected to grow over the next twenty years or so. In 1966, the total installed capacity will be only 12 million kW and in 1961, the conventional power will be 24 million kW and the nuclear power will be 1.2 million kW ; in 1976, 38 million kW will be conventional power and 3 million kW nuclear power ; and in 1986, conventionally generated power will be 90 million kW, its nuclear power component being 18 million kW.

This demonstrates the growing importance attached to nuclear power in my country and we feel that it holds the key to national progress. India is the fifth country in the world to extract plutonium from uranium from April this year. A plant costing £2.7 million has been designed by the staff of the Atomic Energy Establishment at Trombay to process 30 tons of uranium per year, and the plutonium extracted from the plant is expected to meet the needs of the three atomic reactors at Ranapratap Sagar in Rajasthan and at Madras for some years. At the end of the Fourth Plan period, 1.2 million kW will be available. The Tarapur plant for which a contract has been signed with the IGE Export Division, the General Electric being the main contractors, will be India's first nuclear power station and the largest commercial contract even for the General Electric. This demonstrates the growing importance attached to nuclear power in India and that technology holds the key to material progress'.

An official Banquet during the Conference was held in the grand restaurant of the Palais de Beulieu and this was arranged by the Swiss National Committee. Proposing the Toast to the Swiss National Committee were Dr.-Eng. B. R. Edoardo Lombardi, President of the Italian National Committee, Dr.-Eng. D. Hintermayer of Austria, Prof. Alexander Tchetchik, Chairman of the Israel National Committee, and myself.

In supporting the Toast, Shri Cassad said,' 'It gives me great pleasure as a Past-President of the Indian National Committee to propose the Toast of the Swiss National Committee on this momentous occasion of the holding of the Sectional Meeting of the World Power Conference at Lausanne. Our heartiest greetings and congratulations to them for the very wonderful manner in which they have made all the arrangements for the holding of this meeting. The warm welcome and the grand hospitality afforded to us on our visit to this great city speak for themselves and I do not wish to gild the lily except to say 'Thank You' to the Swiss National Committee. It is a grand job they have accomplished in looking after over 1,100 delegates from 40 countries of the world, and the excellent arrangements made for the holding of the International Executive Council Meeting and the Sectional Meeting of the World Power Conference will all remain with us as happy and pleasant memories of our visit to this country.

'Switzerland is well known to us all, and the hard working Swiss people—experts as they are not only in the measurement of time but in their skilful utilization of energy for the high standards they maintain in their products and productivity—deserve very sincere good wishes from us all. We are singularly fortunate that our Conference coincides with the Swiss National Exhibition and we are glad to note the Swiss way of life is paying rich dividends to its citizens'.

At this stage, however, I cannot refrain from mentioning a few facts about my country and I request your indulgence. We have made tremendous strides for the socio-economic development of our country in the three Five Year Plans we are about to complete and we expect to launch the Fourth Plan shortly, by which time we will have 12 million kW installed capacity. It is estimated that this will increase to 90 million kW, the nuclear component being of the order of 18 million kW or so.

We may therefore conclude that the power engineers will have to play a leading role in the building up of their own countries and they must therefore measure up to the responsibility that will be cast upon them to help build a better and peaceful world for the betterment of mankind'.

The closing meeting was held on 17th September, 1964, and was presided over by Sir Christopher Hinton, Chairman of the International Executive Council.

Sir Christopher Hinton, delivered a short address on the achievements of the organization and its functioning and declared the meeting closed.

NEWS AND NOTES

An appeal by Shri T. R. Mehandru

Member

Honorary Secretary, The Association of Consulting Engineers (India), New Delhi

NATIONAL SERVICE AND THE CONSULTING ENGINEER

Building and engineering works, in the public and private sectors, in the Fourth national development Plan period, commencing April 1, 1966, are expected to cost about Rs. 8,000 crores. Some of these may not require the services of consulting engineers but even then the fees payable to the latter may well exceed Rs. 300 crores.

On account of the very difficult foreign exchange position and the limited monetary resources of our country, the Central Government is rightly anxious that most, if not all, of these works should be planned and executed through reliable and competent consulting engineers whose services might be available in the country. Accordingly, it had, early this year, called a conference of various interests in Delhi to consider ways and means whereby this object could be best achieved, through proper cooperation and coordination at various levels.

The higher grade membership of the American Society of Civil Engineers was 52,388 on May 8, 1964. Twenty-nine percent of this number was in professional practice and twenty-three percent at that time was in industry including construction. In the case of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Chemical Engineers, the American Institute of Metallurgical Engineers and the American Institute of Architects, quite a high and satisfactory percentage of their respective membership is in private practice. The result is that through this gallant and enterprising band of consulting engineers the country is making an amazing all-round progress, largely through properly organized and collective efforts.

In the United Kingdom, the Association of Consulting Engineers, established in 1913, with its present membership of about 700, has achieved very impressive and highly creditable success, both in the national and international fields, with the help and close cooperation of the Board of Trade. The position in West Germany, Japan and other progressive countries is equally inspiring.

In our own country, there is decidedly no dearth of talent and experience. Unfortunately, senior engineers have not, on the whole, sufficiently realized their responsibility to the nation so far, nor has the Government given them till now adequate encouragement and support. This position must change for the better. There are vast opportunities ahead for rendering national and even international service. The outlook has in fact never been brighter. We must, therefore, follow the glorious examples set up by the Late Sir M. Visvesvaraya, the Late Sir Ganga Ram, and others.

The Institution of Engineers (India) has at present about 12,000 Corporate Members attached to various Divisions of engineering on its roll. Of this, nearly 2,000 members can, with confidence and credit, take up consultation work, preferably in combination with other Corporate Members, and experienced engineer-friends. All of them, whether mechanical, chemical, metallurgical or specialist engineers, can be of considerable service to the nation. Useful part-time or wholetime employment can be readily secured for retired engineers who are physically fit and can work. It is therefore earnestly suggested that they should organize themselves without any further delay, in the interest of, the nation either on partnership or association basis. Working in combination on a broad and well planned basis can produce, with a spirit of understanding, more satisfactory results.

The Institution had, about six years ago, rightly sponsored the Association of Consulting Engineers (India). It was inaugurated on February 4, 1960, at New Delhi. All qualified engineers, civil, electrical, mechanical, chemical, metallurgical, etc., who have been Corporate Members of the Institution for at least ten years, can join the Association provided they maintain their own office individually or collectively with others, and are not directly or indirectly concerned with the manufacture and sale of goods, and have no financial interest in contracts.

The Association receives enquiries from time to time from various sources in regard to suggesting names for various types of consultation work. These parties desire to be informed whether consulting engineers who can meet their requirements properly are available in the country. Besides, the government and the public must also know the correct position.

We must meet the challenge and help the nation to build up its economy and status, substantially raise the standard of living of our people, and make our building industry better geared for increased responsibilities and substantial and satisfactory progress.

The larger the number of qualified engineers who take up professional work with devotion and enthusiasm, the wider will be the field for them for real and the much needed service to the nation. In this national cause, those who can join the Association, specially electrical, mechanical, chemical and industrial engineers and others having specialized experience and qualifications, are requested to contact me for necessary membership forms, additional information and advice. The address of the Association is : 14 Ajmeri Gate Extension, opposite Kamala Market, New Delhi.

Refresher Courses at the University of Roorkee, Roorkee

The Director of Refresher Courses, University of Roorkee, Roorkee, desires to inform that the following courses will be held :

(a) Summer Institute Courses for teachers of technical colleges

1. Design of Steel Structures .. 3rd to 29th May, 1965
2. Application of Colloid Science and Electro-chemistry in Engineering and Technology .. 24th May to 19th June, 1965
3. Theory of Internal Combustion Engines and Gas Turbines .. 21st June to 17th July, 1965

Support to participants will be available in the form of free boarding, lodging and limited T.A. The number of seats is limited.

(b) Courses for serving engineers

1. Refresher Course in Electrical Engineering .. 9th April to 8th July, 1965
2. Refresher Course in Civil Engineering (Irrigation) .. 9th May to 2nd August, 1965

(c) Specialist courses

1. Modern Electronic devices .. 10th to 31st May, 1965
2. Engineering Mathematics .. 1st to 30th June, 1965
3. Heat Treatment of Metals .. 2nd to 23rd July, 1965
4. Design of Water Towers .. 6th to 31st July, 1965
5. Mechanical Design of Transmission Lines Towers .. 10th to 31st July, 1965

Full particulars may be had by sending a self-addressed stamped 9 in. × 4½ in. envelope from Shri B. D. Goyal, Director, Refresher Courses, University of Roorkee, Roorkee.

FORTHCOMING CONFERENCES

Symposium on 'Fire Resistance of Prestressed Concrete', Germany, June 9-11, 1965

The FIP And Hoc Committee on Fire Resistance of Prestressed Concrete in conjunction with the German Group of the FIP has arranged a Symposium on 'Fire Resistance of Prestressed Concrete' to be held in Braunschweig, Germany, from June 9-11, 1965. Participation in the Symposium will be restricted to those who are particularly concerned with the subject of Fire Resistance and who can make some contribution to the Symposium.

The topics that will be dealt with at the Symposium are :

(i) Effects of restraint of longitudinal deformation or rotation ;

(ii) Special questions such as : spalling, protective layers, influence of prestressing systems ;

(iii) Economical problems and qualifications of fire resistance to official regulations ; and

(iv) Behaviour of prestressed concrete members in actual fires compared with test results for future standards.

Further details can be obtained from the Technical Officer (Scientific), The Institution of Engineers (India), 8 Gokhale Road, Calcutta 20.

Mining Machinery Exhibition, Olympia, July 8-17, 1965

The Mining Machinery Exhibition will be held at Olympia, from July 8-17, 1965. Occupying almost 220,000 sq. ft. of floor space, the exhibition will be not only the largest, but the most comprehensive ever to be staged in the United Kingdom.

Planned by the Council of Underground Machinery Manufacturers the exhibition to date has attracted exhibits from 113 firms, all of whom are acknowledged as world leaders in mining technology. With automation and heavy mechanization as its theme, the exhibition's slogan, 'Coal Plans for Power', summarizes the outlook for the mining industry today and in the future.

The Fourth International Mining Congress will take place during the run of the exhibition, when some 42 papers will be read by leading engineers from 22 countries.

International Conference on Thermionic Power Generation, London, September 20-24, 1965

The International Conference on Thermionic Power Generation will be held under the auspices of the Organization for Economic Cooperation and Development

(O.E.C.D.), European Nuclear Energy Agency by the Institution of Electrical Engineers, Savoy Place, London, from September 20-24, 1965. The object of the Conference is to examine current research on thermionic processes for direct conversion of energy into electricity, and to assist the dissemination of information on this view and promising technique, specially in its relation to nuclear and space applications. Those wishing to offer material are asked to send a provisional title and brief synopsis of their proposed contribution to the Conference Secretariat, T.E.P.G., The Institution of Electrical Engineers, Savoy Place, London W.C. 2, by February 28, 1965.

The Sixth International Essen Welding Fair, Germany, September 25 to October 3, 1965

The Sixth International Essen Welding Fair will be held in Essen from September 25 to October 3, 1965. The fair is organized by the Deutscher Verband Schweiptechnik e.v. (D.V.S.)—the German Welding Association.

More than 200 firms will be exhibiting their products of newest fashion in 12 stalls with a total surface area of 40,000 sq. meters. 25% of the exhibitors are expected to come from: France, Belgium, Holland, Great Britain, Denmark, Sweden, Finland, Switzerland, Austria, Italy and the U.S.A.

Symposium on 'Changing Concepts of Human Habitation', Roorkee, December 1965

The Central Building Research Institute, Roorkee, proposes to hold a Symposium on 'Changing Concepts of Human Habitation' at Roorkee, India, sometime in December 1965, with a view to reviewing the trends in architectural concepts for the progressive execution of building programmes. The Symposium will explore the contribution of various factors in the moulding of human habitation in view of social, scientific and technical advancements in the field of architecture. Discussion will be carried out in four technical sessions devoted to the following themes :

(i) Human and social needs ;
(ii) Planning concepts and bye-laws ;
(iii) Architectural concepts and values ; and
(iv) Building materials and techniques.

The summary of the paper for presentation may be sent to Shri P. L. De, General Secretary, before April 30, 1965. Last date for submission of the full paper is June 30, 1965. Further details can be obtained from the General Secretary, Symposium Organizing Committee, Central Building Research Institute, Roorkee, U.P.

Fifth International Congress of the Precast Concrete Industry, London, May 21-27, 1966

The Fifth International Congress of the Precast Concrete Industry will be held at the Royal Festival Hall and the Royal Garden Hotel in London, from May 21-27,

1966. The programme for the Congress will include an introductory review of outstanding achievements, followed by sessions on the following subjects :

(i) Structural precast concrete :

(ii) International developments in machinery for the precast concrete industry ;

(iii) Concrete pipes, culverts and tunnel segments ;

(iv) New products, new techniques and outstanding applications ;

(v) Recent research on precast concrete ;

(vi) The architect and precast concrete ; and

(vii) Developments in the manufacture and use of concrete blocks.

Further details can be obtained from the Organizing Secretary, Fifth International Congress of the Precast Concrete Industry, Terminal House, Grosvenor Gardens, London S.W. 1.

BOOK ACKNOWLEDGMENTS

1. **Architectural Design.** K. R. Moudgil. *New Asian Publishers*, Delhi, Rs. 15.00, 1st edition, 1964, 96 pages.

This first edition of a book on 'Architectural Design' is meant to introduce the redress to the study of the subject. Classic architecture, *i.e.*, the Greek and Roman has been explained in the first eight chapters. The next four chapters deal with Indian architecture followed by principles of architectural composition and specialized design. The subject matter has been amply illustrated in the book readers with plates.

2. **Simplified Problems in Strength of Materials.** O. P. Grover. *Frank Bros. & Co.*, Delhi, Rs. 7.50, 270 pages.

This book deals with solved problems in strength of materials in the metric system. The book is meant for the use of undergraduate courses of Indian universities and students Intending to study for the Associate Membership Examinations of the professional institutions. Problems have been selected to acquaint the students with practical engineering problems.

3. **Applied Mechanics, Vol. 1.** J. C. Mehta. *New Asian Publishers*, Delhi, Rs. 10, 1963, 380 pages.

This book in the M.K.S. system is intended to serve as a text book for those appearing in the National Certificate examination of the All-India Council for Technical Education and the various diplomas awarded by the State Boards. It is intended to serve as a guide for the students preparing for the university degree in engineering or the Associate Membership Examinations of professional institutions. The subject matter is explained stressing the fundamentals.

4. **Applied Electricity.** S. P. Singhal. *New Asian Publishers*, Delhi, Rs. 12.50, 2nd edition, 1964, 592 pages.

This second edition of the book provides a treatment of the basic principles of electrical engineering and is intended to be useful to students appearing in the examinations of professional institutions. A number of specimen problems have been worked out in the book. Useful data, charts and tables for logarithms are included at the end.

5. **Basic Technical Mathematics with Calculus.** A. J. Washington. *Addison-Wesley Publishing Co., Inc.*, Reading, Massachusetts, $ 8.75, 1964, 595 pages.

This book presents an integrated treatment of mathematical topics from algebra to calculus and is meant to give the readers the sound, complete mathematical training demanded by industry today. Many practical applications useful as a background for technical courses are included. Sufficient calculus is included in the book to give an understanding of its concepts and facility in handling the notations. A concluding chapter offers a brief introduction to differential equations.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

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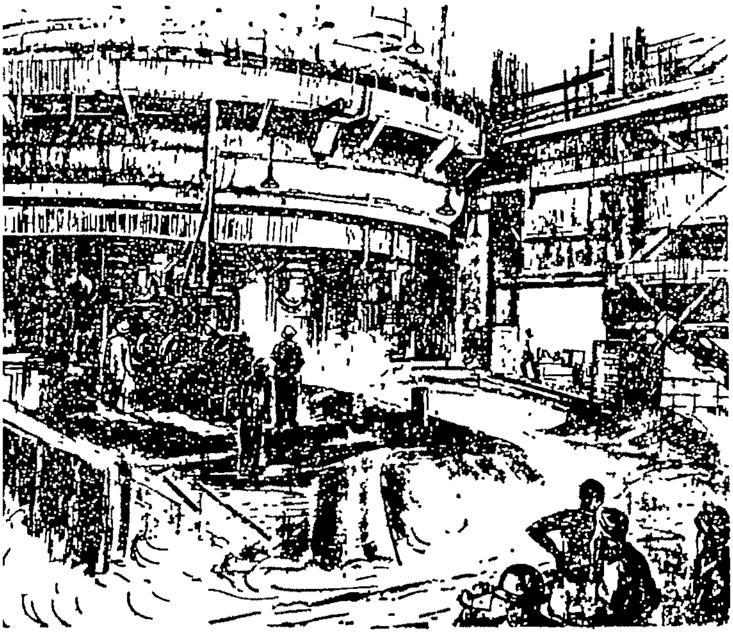

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THE BULLETIN
OF
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SECRETARY & EDITOR: B. SESHADRI, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.

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ADVERTISEMENTS IN THE INSTITUTION'S PUBLICATIONS

Members are well aware that the existing inflationary conditions compel the Institution to seek every possible means to supplement its income in order to combat the rising costs, so that the services to its members and the engineering profession as a whole will not only be maintained but expanded. Costs have particular validity when the Institution's publications are concerned, the scale and scope of which are unprecedented for any organisation in this country.

The Headquarters, therefore, consider it necessary to do all they rightfully can to increase the quantity of advertisements in the publications. A greater number of advertisement pages would be of real help in offsetting some of the expenses of the publications

It is stressed that the Journal in all its Parts, the Bulletin and the Year-Book have also a large circulation oversea and suitable advertisements in them can materially aid the present drive to the export more of India's engineering products. There is also great scope for advertisement of the products and equipment supplied by constructional, light engineering and ancillary industries, and for firms whose goods and services will appeal to members as individuals. The Headquarters believe that these publications are most attractive media for this type of advertisement and that many members connected with firms would be glad to use this means of publicizing their activities. Also, as increasing proportion of commercial and executive positions in industrial, contracting and public organisations become occupied by professional engineers, so do the publications reach more and more to those to whom engineering advertisements are directly useful.

Members whose positions enable them to help the Headquarters in this effort are requested to bring to the notice of publicity managers the merits of the Institution's publications as channels for reaching purchasers of engineering equipment. A brochure giving full particulars of rates and other information may be obtained from the Technical Officer (Scientific) at the Headquarters at 8 Gokhale Road, Calcutta 20.

PLANNING AND EQUIPPING UNDERGRADUATE ELECTRONICS AND TELECOMMUNICATION LABORATORIES

S. Ramabhadran
Non-member

In a standard university B.Sc. course in electrical engineering, the student has to take up the study of both 'power and machines' and 'telecommunication', although option is given to take one at the main level and the other at the subsidiary level. In the third year of a five-year integrated course, basic electronics is taught to civil, mechanical, electrical, textile and chemical engineering students. The fourth year course includes advanced electronics for electrical, mechanical and chemical engineering students. The final year course for the electrical engineering group opting for 'communications', should cater for radio communication, line communication and V.H.F. and microwave technology. While the principal aim of laboratory work should be to enable understanding of the basic principles, incidentally, an introduction to the study of telecommunication systems and circuit utilization should also be included. Although it may not be desirable to have rigid plans and the actual practices will differ from place to place, certain generalized suggestions can be made and thought must be given to the planning of teaching laboratories, since practical work and laboratory experiments occupy a very significant place in technical education.

It is good practice to provide about 60 sq. ft. per student (*i.e.*, 16 students in a laboratory of 40 ft.×24 ft.). Preparation rooms are useful where they are provided with working areas, mains supplies and access to the corridor as well as to the laboratory. Storage accommodation is required by way of drawers and cupboards with adjustable partitions. Adequate arrangements are needed in respect of lighting, ventilation and water supply. The floors should be mechanically durable and the wall space has to be utilized for windows and doors and for cupboards and bench shelves as well as for mounting wiring circuits.

In respect of laboratory furniture, movable benches, 5 ft.×3 ft. 6 in.×2 ft. 9 in. high, say, are satisfactory and the fixed wall benches have also to be of the same height. Stools can be about 10 in. lower than the benches and rubber-shod. Also, extra shelves above and below the main working surface of the bench are required to house power-packs, transformers, oscillators, valve voltmeters and cathode ray oscilloscopes, which will not be altered in position during the run of an experiment.

Each bsic laboratory should include experiments for the teaching of fundamentals, while in the advanced laboratory an attempt has to be made to provide for developments in technology and to enable students concentrate on the particular object of an experiment or test on hand. Provision should also be made, at least on a limited scale, for research and development work by both the staff and the students. A useful addition is required by way of a central room where students may write up their laboratory reports and which can be incidentally used for demonstration of special equipments, Each basic laboratory may have 16 bench working positions, each supplied from a central control board with 240 volts A.C., 6.3 volts A.C. for heaters and 250 volts D.C. for H.T. and coaxial interconnection facilities, so as to afford standardization in the manufacture of numerous experimental units in the department itself. In the advanced electronics telecommunication laboratory, there is need for a variety of working spaces and supply arrangements ranging from empty floor space to benches complete with instrument racks and separate power units. A large development section is required to provide facilities for research and development work for the senior staff. Protective gear by way of small circuit-breakers will be an asset both at control points and on the main switchboard. This avoids the waste of time in location and replacement of blown fuses in the conventional system of protection; the circuit-breaker on the other hand gives a visual indication, enabling the supply to be restored quickly and is to be preferred to switch fuses, although more expensive. Circuit-breakers of 15 amp. capacity, tripping at 50% overload, should be adequate for the bench points. The size of the distribution cables should be generous in order to have stability of supply. Inexpensive stabilized power packs are available and useful for electronics experiments. In order for cater to supply to power packs, signal generators and oscilloscopes, a 240 volts, 50 cycles per sec., 15 amp. ring main can be provided.

Broadly speaking, the aims of laboratory work should be as follows: to develop skill in the experimental method which forms the basis of all scientific investigations, to augment and complete the theoretical aspects of engineering education, to help students to understand and confirm theory, to evolve laboratory techniques, to enable students to get familiar with standard methods of measurement and standard items of equipment, to develop a critical attitude towards all observations and to help to develop the art of writing concise English.

In general, planning for a maximum of 16 students working in batches of two appears to be reasonable. Hence, 8 bench positions are required and each working area should have an adequate number of, say, six socket outlets for 240 volts, 50 cycles per sec. mains supply with standard plugs and also for 6 volts A.C. and other supplies. Each type of supply should have a distinctive termination to avoid any interchanging. Every working point must be provided with a low frequency oscillator, a general purpose oscillograph and a valve voltmeter together with a reasonable number of decade box type of resistors, inductors and capacitors. Central locations will require the use of A.M./F.M. R.F. generator, wideband oscilloscopes, Q-meter, universal impedance bridge, frequency meter and waveform analyzer. A number of experimental units can be locally built for students' experiments. For day to day smooth working, the services of an electronic technician and a steward are required.

The list of topics developed from the expanded syllabus of the course can be translated into a scheme of practical work and this can be split up into laboratory cycles of say 4, 6, or 8 experiments per cycle, the number of cycles matching the number of groups. From these lists, an experimental list can be drawn up. On this, all the items of equipment needed for each experiment are shown and include instruments, resistors, etc., so that exact reports of a particular experiment can be had.

An experimental schedule can be made out and duplicated for distribution to each student. With this time table, the student will be in a position to go to the right bench and commence the allotted experiment. This way he would know and read about the required experiment before coming to the laboratory. One week in each cycle can be allotted for arrears of experiments which had not been satisfactorily completed earlier. In the earlier years, batches of two students are essential. while at advanced levels, individual work is desirable. Students may be allowed to choose their partners in the beginning. The apparatus for experiments can be normally stored as units in cupboards close to the benches where they are to be used. The apparatus and laboratory instruction card can be laid out before the student arrives in the laboratory and should be stacked by the laboratory steward after the experiment is finished. The students must be required to write their reports in their own style on the experiment and in the way it was actually performed. Model laboratory notebooks may be made from sets of loose sheets, each set comprising a graph sheet on the front page, titled on one side and with a circuit diagram on the other side, ruled paper for the centre pages and further graph sheets at the back. The instructor, the technician and the steward alike should coordinate their activities to constantly keep the laboratory work up-to-date. Students' reports should be corrected regularly to enable the students rectify errors and misconceptions and to learn to interpret the results. Assessment should be based on laboratory techniques, laboratory conduct, initiative and ability on the part of the students to tackle engineering problems. It is also good practive to equip the laboratory with a good collection of text-books, journals, manufacturers instruction leaflets and handbooks.

The number of experiments prescribed for the different years of the course and value of equipment needed is indicated below.

Year	Number of experiments	Value of equipment, Rs.
Third year	16	1,20,700
Fourth year	28	1,90,220
Fifth year (Radio Communications)	24	1,55,730
Fifth year (Lime Communication)	24	1,37,790
Fifth year (Microwave Technology)	24	3,47,880

MINUTES OF THE SPECIAL GENERAL MEETING OF CORPORATE MEMBERS HELD IN LUCKNOW ON SATURDAY, 20TH FEBRUARY, 1965

A Special General Meeting of Corporate Members of the Institution was held in the building of the Uttar Pradesh Centre of the Institution, River Bank Colony, Lucknow, on Saturday, 20th February, 1965, at 3.00 p.m. for the purpose stated in the Notice of the Meeting dated 5th January, 1965, printed in the December 1964-January 1965 issue of the *Bulletin.*

One hundred and fifty-three Corporate Members attended the Meeting, and it was presided over by the President, Dr. T. Sen.

The President said that the Notice of the Meeting had already been circulated, together with an Explanatory Note, which the members would have read. He asked if any member had comments to make.

Shri Jatindra Singh (*M.*) said that a Special General Meeting such as the one being then held had no authority to consider the decision taken at the Extraordinary General Meeting of the Corporate Members held in Bombay on 24th October, 1964. It was, therefore, his opinion that the Meeting was not in order.

Shri K. C. Banerjee (*M.*) then proposed that the resolution of the 437th Council meeting dated 13th December, 1964, which was before the house for consideration be adopted. This proposal was seconded by Shri S. Padhi (*M.*).

The President then said that Shri Banerjee's proposal seconded by Shri Padhi was before the house. He asked if there were any members who were in agreement with the contention of Shri Jatindra Singh, and those in favour to put up their hands. Only Shri Jatindra Singh showed his hand. The President then asked those who did not accept Shri Jatindra Singh's contention to show their hands. An overwhelming majority of members raised their hands.

The President thereupon asked those in favour of Shri Banerjee's resolution to signify accordingly. An overwhelming majority of those present did so. The President then announced Shri Banerjee's resolution as carried.

With a vote of thanks to the Chair, the Meeting terminated at 3.15 p.m.

PROCEEDINGS OF THE FORTY-FIFTH ANNUAL CONVENTION LUCKNOW, FEBRUARY 20-23, 1965

The Annual General Meeting

Business Session, Saturday, February 20, 1965

The Forty-Fifth Annual General Meeting was held in the building of the Uttar Pradesh Centre, River Bank Colony, Lucknow, on Saturday, February 20, 1965, at 3.30 p.m.

One hundred and fifty-three Corporate Members attended the Meeting, and it was presided over by the President, Dr. T. Sen.

1. After welcoming the delegates to the 45th Annual General Meeting, the President took up the minutes of the 44th Annual General Meeting, circulated to all members of the Institution in the March 1964 issue of the *Bulletin*, for confirmation.

The President put the minutes to the house. Shri D. P. R. Cassad (*Member*) proposed that the minutes be confirmed. Dr. H. C. Visvesvaraya (*Member*) seconded the proposal. It was carried unanimously.

2. The President next took up the Annual Report of the Council, printed in abstract in the December 1964 issue of the *Bulletin*, and the Audited Accounts for the year ended August 31 1964, and asked if members had any comments to make.

Prof. M. V. Deshpande (*Member*) proposed that the Annual Report be adopted and the Audited Accounts be approved. Shri D. R. Limaye (*Associate Member*) seconded the proposal. It was carried unanimously.

The President said that he had a sad duty to perform at this stage. He referred to the list of members who had passed away during the Institution year 1963-64 given in the Annual Report. He then read out the names and requested the members to pay their respects to the deceased by standing and observing one minute silence.

3. The President then asked the Secretary to read the report of the Council on the elections for the session 1965-66 of the President and the Council. The Secretary, Shri B. Seshadri, read as follows :

(i) Prof. N. S. Govinda Rao had been elected by the Council as President for the session 1965-66. (*Applause*);

(ii) The following members by virtue of their having been elected Chairman of Local Centres become members of the Council under Bye-law 44 :

Andhra Pradesh Centre	Shri V. Parvathesam
Assam Centre	Shri K. Mazumdar
Bengal Centre	Shri S. K. Majumder
Bihar Centre	Shri S. N. Sinha
Bombay Centre	Shri D. R. Bhise
Delhi Centre	Maj.-Gen. R. A. Loomba
Gujarat Centre	Shri G. S. Desai
Jammu & Kashmir Centre	Shri H. K. Gandotra
Kerala Centre	Shri T. P. Kuttiammu
Madhya Pradesh Centre	Shri M. Y. Koli
Madras Centre	Shri N. G. Mahalingam
Mysore Centre	Shri R. A. Rajagopal
Nagpur Centre	Shri R. M. Tarkunde
Orissa Centre	Shri S. Padhi
Poona Centre	Col. R. V. Godbole

Punjab Centre	Shri I. N. Mehta
Rajasthan Centre	Shri T. M. Desai
Uttar Pradesh Centre	Shri J. P. Mital

(iii) The following members by virtue of their having been elected from the Divisions become members of the Council under Bye-law 44 :

Civil Engineering Division ..	Shri K. F. Antia Shri M. Ganapati Shri K. K. Nambiar
Electrical Engineering Division ..	Shri N. N. Chakrabarti Prof. M. V. Deshpande Prof. H. C. Guha
Mechanical Engineering Division ..	Dr. A. Bhattacharyya Shri T. R. Gupta Maj.-Gen. S. P. Vohra
Chemical Engineering Division ..	Shri S. Ghosh Shri S. K. Mukherjee
Electronics and Telecommunication Engineering Division ..	Prof. S. P. Chakravarti Brig. M. K. Rao
Mining and Metallurgy Division ..	Dr. G. P. Chatterjee Shri H. Nandy
Public Health Engineering Division ..	Prof. C. H. Khadilkar Shri R. S. Mehta

4. Shri K. C. Banerjee (*Member*) proposed that Messrs. Price, Waterhouse, Peat & Co. be reappointed Auditors of the Institution for the year 1964-65 on a remuneration of Rs. 6,000 per annum. This was seconded by Shri G. C. Goswami (*Member*). It was carried unanimously.

Shri D. P. R. Cassad (*Member*) while moving a vote of thanks to the retiring President, Dr. T. Sen, also proposed that the appreciation of the house of his leadership of the Institution during the sessions 1963-64 and 1964-65 should be recorded in the proceedings of this Meeting. These proposals were adopted unanimously by the house.

Shri Cassad also proposed that the house's appreciation of the administration of the Institution by the Secretary, Shri B. Seshadri, should also be recorded in the proceedings. This proposal was also carried unanimously.

With a vote of thanks to the Chair, the Meeting terminated at 3.45 p.m.

Inaugural Session, Sunday, February, 21, 1965

The Inaugural Session was held in Ravindralaya, Lucknow, on Sunday, February 21, 1965, at 9.30 a.m. Over 900 members and guests attended the Session.

Shri M. C. Chagla, Union Minister of Education, inaugurated the Session. He arrived at Ravindralaya at 9.20 a.m. He was received by Shri J. P. Rawat, Minister for Public Works, Uttar Pradesh, and Chairman of the Reception Committee of the Uttar Pradesh Centre, Dr. T. Sen, President, and Shri J. P. Mital, Chairman of the Uttar Pradesh Centre, and introduced to the President-Elect, Prof. N. S. Govinda Rao, Past-Presidents, and members of the Council for the session 1965-66.

This was followed by a group photograph.

Messages for a successful Convention were received from the following :

The President of India; the Vice-President of India; the Prime Minister of India; the Governor of Orissa; the Governor of Punjab; the Governor of Rajasthan; the Governor of Uttar Pradesh; the Union Minister for Rehabilitation; the Union Minister for Irrigation and Power; the Union Mninister of Industry & Heavy Engineering; the Chief Minister of Uttar Pradesh; Shri A. P. Jain, Chairman, Rural Urban Relationship Committee; Shri K. Tripathi, President, Uttar Pradesh Congress Committee; Shri C. B. Gupta, ex-Chief Minister of Uttar Pradesh; the Engineering Institute of Canada; the South African Institution of Civil Engineers; the Institution of Mechanical Engineers, U.K.; the Institution of Electrical Engineers, U.K.; and the Institution of Chemical Engineers, U.K.; Société Royale Belge des Ingénieurs et des Industriels, Belgium; and Verein Deutscher Ingenieure, West Germany.

1. Shri J. P. Rawat, Minister for Public Works, Uttar Pradesh, and Chairman of the Reception Committee of the Uttar Pradesh Centre, welcomed the delegates to the city of Lucknow as follows :

'Shri Chagla, Dr. K. L. Rao, Prof. Govinda Rao, Dr. Sen, Ladies and Gentlemen,

It gives me great pleasure to extend to you all on behalf of the Uttar Pradesh Centre of the Institution of Engineers a very warm welcome to this Forty-fifth Annual Convention. I am particularly happy that this year Lucknow has been chosen for the venue of this Annual Convention. This ancient city, though not very much industrially advanced, has a history and culture of its own, which, if I may say so, make it one of the most interesting cities of India. It was here that the freedom battles were fought under the leadership of Begum Hazrat Mahal. The many ancient buildings here are still regarded as marvels of architecture and engineering. The famous Rumi Darwaza and the archless roof of Asaf-ud-daula's Imambara, remind us of the imagination and architectural skill of those times.

I attach great value to this opportunity of meeting distinguished engineers who have come here from all parts of the country. Today, more than ever, we realize the great role engineers are playing in the development of the country under a pressing economic situation and persisting threats on our borders. There has not been a single period in history when engineers did not contribute a major share towards the country's progress. Even in the Puranic ages, engineers had a prominent place. Who can underestimate the engineering feats of Vishwakarma and Maiya. During the Ramayana period also, we had Nal and Neel who built the famous Setu bund.

Emphasis has been laid on different aspects of human civilization in different periods of history. There was an era which was prominent for its emphasis on the sword. Then there came a period when there was great stress on art and culture, which manifested itself through sculpture and painting. Mohenjodaro in India and the picture galleries in Rome are evidence of that era. The temples of Madras, Madhya Pradesh and Orissa are the repositories of India's art and culture. They represent some of the finest. specimens of architecture, sculpture and engineering. The monolithic temples carved out of rock at Mahabalipuram, the thousand-pillared hall of the Meenakshi temple at Madurai, the long and grand galleries of Rameswaram temple, the exquisitic carvings of Khajuraho and Konarak, the 200-ft. high conical tower of the Jagannath temple at Puri, are all living testimony to the superb skill, craftsmanship and creative genius of the artisans and engineers of old India. In another era, philosophers reigned supreme and commanded respect from everybody. Buddha. Sankaracharya and Christ held their sway over a vast multitude of people during that period. But the modern age has shelved all these eras in the background. The present is the age of scientists and technologists. We perceive only in technology the solution of most of the human problems whatsoever be their magnitute. But this scientific and technical knowledge is a double edged weapon. This energy can be diverted towards constructive and peaceful uses. The wonders of the world are necessarily the products of the imaginative and creative powers of the scientists, engineers and technologists. The Taj in India and the Eiffel Tower in Paris are instances of human ingenuity. On the other hand, this knowledge can be utilized—rather misutilized—for destructive purposes also and may cause the annihilation of the human race. But, I need hardly say, we are pledged to make use of science and technology for the welfare of humanity.

Distances have considerably shrunk due to improvements in technology and air communications. Where it was difficult and time-consuming to construct even small bridges, hundreds of thousands of feet of bridging has been and is being constructed in the world. The famous Golden Gate Bridge near San Francisco in the United States with a suspension span of 4,200 ft., the Macraibo Bridge in Venezuela—a five-mile long bridge with spans as big as 700 ft.—in prestressed concrete, the Firth of Forth Bridge in Scotland, the proposed 970-ft. long and 105-ft. wide seven-storeyed bridge across the Thames in London which will not only have carriageways but also hotels, restaurants, shops, open air theatre, art galleries, car parks, etc. are marvels of modern engineering concepts and technology. In India also great strides are being made. The Jawahar Bridge over the Brahmaputra at Gauhati, the Mokamah Bridge over the Ganga in Bihar, the over 10,000-ft. long Mahanadi Bridge in Orissa, are a tribute to the knowledge and technical skill of our Indian engineers. There was a time when even the proverbial needle was not manufactured in the country, but now we are turning out complicated machines, engines, aeroplanes, etc. In India, these achievements have been possible after we attained independence. And we feel proud of our achievements. But we are still backward in many respects and much needs to be done. We are short of technical personnel and material resources.

There is pressing need for engineers in every walk of life. The transformation of our country from rural to an industrialized economy needs selfless, devoted and persistent efforts on the part of the engineers. Since the dawn of political independence, we are trying to lay sound foundations for self-sustaining economic growth. In this task, you have been playing a very important role, and will, I am sure, occupy a sacred place in the history of the nation. The labour you put in can never be repaid in terms of money but you get your reward when your labours take a concrete shape.

We are going to formulate our Fourth Five Year Plan, and it is at this juncture that we ought to assess our achievements. For the whole country, we anticipated in the Third Plan an expenditure of Rs. 1,738 crores on agriculture and irrigation, Rs. 1,187 crores on power, Rs. 1,940 crores on transport and communication, Rs. 112 crores on housing and construction, and Rs. 1,895 crores on industries. In the Fourth Plan, allocations are expected to be Rs. 3,400 crores for agriculture and irrigation, Rs. 1,950 crores for power, Rs. 300 crores for transport and communication, Rs. 400 crores for housing and construction, and Rs. 3,650 crores for industries. The outlay of the Third Plan for our State will give an indication of the responsibility which our engineers have to shoulder. These Plan outlays are Rs. 51.96 crores for minor irrigation, Rs. 62.56 crores for major and medium irrigation and floods, Rs. 122.35 crores for power, Rs. 26.25 crores for industries, Rs. 39.24 crores for transport and communication, and Rs. 8.52 crores for technical education. In the proposed Fourth Plan, these figures are likely to increase manifold. All the above items will need a large force of engineers and I am sure in this Convention many suggestions will be forthcoming which will greatly benefit the country in its huge task of development.

The Institution of Engineers is the most appropriate forum for the acquisition and dissemination of technical knowledge so important to the nation. The Conventions offer opportunity and facility for interchange of technical knowhow. I am happy to know that you are also holding a Seminar on 'Engineering Education and Its Development'. We are short of technical personnel. It has been estimated that the additional requirement of the Fourth Plan is 75,500 graduates and 150,000 diploma holders. These numbers will greatly increase during the Fifth Plan. I am sure while arranging to turn out such large numbers of technical personnel in the shortest possible time, every effort will be made not only to maintain but improve their standard. While discussing this aspect, I hope you will offer suggestions about the optimum utilization of existing engineering personnel also.

You will be discussing many problems besetting us but I would also like you to devise means for attaining greater speed in construction activities without in any way sacrificing quality and increasing the cost disproportionately. While designing bridges, buildings and roads, we should not lose sight of the aesthetic sense, their finish and landscape. At present, there is great shortage of some building materials such as cement, iron, etc. Efforts should be made to devise ways and means for making use of other materials which are more easily available so that scarcity of any particular thing may not hamper the consummation of our plans.

It is a matter of great pleasure and privilege to us that this Convention is being inaugurated by Shri M. C. Chagla, an eminent jurist of our country, now shouldering the heavy burden as Education Minister of India. I am sure his address will have a great educative value for us all. Dr. K. L. Rao, an eminent engineer of international repute, now Minister for Irrigation and Power, India, is also among us on this occasion to give his valuable advice and to guide the deliberations.

I have no doubt that you will enjoy the cultural programmes arranged for you and will find the excursions both a useful and pleasurable experience. We have tried our best to make suitable arrangements for the stay of the delegates. There might be certain shortcomings which I hope you will not mind. I hope you will carry back with you pleasant memories of this Convention.

I must express my deep sense of appreciation and thanks to all those who spared no pains to make the necessary arrangements for this Convention.

Once again, I accord a hearty welcome to you all.

Jai Hind.'

2. Dr. T. Sen, President, then requested the Secretary, Shri B. Seshadri, to announce the award of prizes by the Council. Shri Seshadri announced as follows :

1. The Union Ministry of Irrigation and Power Gold Medal and Cash Award for the best paper on Civil engineering aspects of power development to Prof. R. S. Chaturvedi (*M.*) for his paper 'Expansive Sub-Critical Flow in Open Channel Transitions'.
2. The Union Ministry of Irrigation and Power Gold Medal and Cash Award for the best paper on power development and utilization to Sarvashri S. M. Zubair (*M.*) and F. C. Kohli (*A.M.*) for their paper 'Economics of Long Distance Extra High Voltage Transmission Lines'.
3. The Railway Board's Second Prize to Shri P. C. Neogi (*M.*) for his paper 'Trends in Wagon Design of Indian Railways'
4. The John C. Gammon Prize for the best paper on Shell Structures to Shri G. S. Ramaswamy (*M.*) and Shri M. G. Tamhankar (*Non-member*) for their paper 'Continuous Northlight Folded Plate Roof for the Indo-Swiss Training Centre for Precision Mechanics'.
5. An Institution Prize to Sarvashri B. M. Agarwal (*Non-member*) and S. K. Basu (*A.M.*) for their paper 'Influence of Nose Radius of a Single-Point Cutting Tool on Surface Finish in Fine Machining'.
6. An Institution Prize to Sarvashri C. V. Govinda Rao (*A.M.*) and and R. Mathur (*Non-member*) for their paper 'Generalized Circuit Theory of Electrical Machines—1, 2 and 3'

For the papers read at the Students' Session held on 20th February, 1965, the following prizes were awarded :

1. The First Prize to Shri B. G. Rao and Shri Amar Singh for their paper 'Investigation on Some Aspects of Load Tests on Sandy Soils'.
2. The Second Prize to Shri B. Nagaraja Rao for his paper 'Infra-red Radiation and Its Military Applications'
3. The Third Prize to Shri M. K. Saxena for his paper 'Recent Advances in Soil Stabilisation with Lime'.

As the prizes were announced by the Secretary, the presentations were made by Shri Chagla to the recipients who were present. They were Prof. Chaturvedi, Sarvashri Kohli, Ramaswamy, Govinda Rao, B. G. Rao, Nagaraja Rao and Saxena.

3. Dr. Sen then conferred the Honorary Life Membership of the Institution on Shri N. V. Modak, and called upon the Secretary, Shri B. Seshadri, to read the citation for Shri Modak. Shri Seshadri read the citation as follows :

'After taking the B.E. degree in Civil Engineering from the College of Engineering, Poona, in 1911, Shri Narayan Vinayak Modak worked with the Sanitary Engineer to the Government of Bombay for about six years when he obtained much practical experience in the investigation, design and execution of water supply and sewerage schemes for the local authorities in the then Bombay Presidency which included Karnatak, Gujarat and Sind.

He was awarded a State Technical Scholarship by the Government of India for special practical training in Sanitary Engineering in the United Kingdom. He worked for three years with the Corporation of Hastings where he designed and executed projects including a sewerage scheme for the then unsewered parts of Hastings, a water treatment plant, an arterial road which included a bridge, and housing schemes.

After his return from England in 1922, he was selected for the post of Sanitary Engineer under the then Great Indian Peninsular Railway where he worked for a period of eight years. During this period, he designed and executed several water supply schemes for railway stations and railway colonies including water treatment and water softening plants, and storm water and sewerage schemes. He was the first Indian to be recruited direct as Executive Engineer in the Railway Administration. He acted as Adviser to the then Bombay, Baroda and Central India Railway for the sewerage scheme of Dohad.

In 1930, at the request of the late Sir Ardeshir Dalal, the first Indian Municipal Commissioner for Bombay Municipality, Shri Modak joined the Bombay Municipal service and served that body for a period of nearly 30 years in different capacities as Deputy City Engineer, Hydraulic Engineer, City Engineer and Special Engineer. He was the first Indian to be appointed to the post of City Engineer. He also acted as Municipal Commissioner, a post then reserved for a senior member of the Indian Civil Service. On retirement from the service of the Corporation, he acted as its Consultant for three years.

During his service with the Bombay Municipal Corporation, he designed and executed major projects costing crores of rupees such as augmentation and distribution of water supply, provision of storm water drainage, sewerage and sewage treatment, road construction, collection and disposal of refuse, housing, and slum clearance. He designed and built the Vaitarna Dam, the first mechanized all-concrete dam in the country, for the augmentation of Bombay's water supply. He designed and laid an aggregate length of 70 miles of welded mild steel pipeline, 120 in. and 96 in. diameter, of the ring girder type as part of the Vaitarna-Tansa Scheme, the first of its kind in India. He carried out the work of strengthening of the Tansa Dam by the Coyne method when it was found to be unstable according to modern principles in the design of gravity masonry dams. He built the first sludge digestion tank in the country at the Dadar Sewage Purification Works in Bombay and utilized the sludge gas both for domestic and motive purposes.

As a town planner, Shri Modak prepared a Master Plan for Bombay as far back as 1948 for its orderly development and for reducing the population in the city proper by accommodating the spillover population in the suburbs and in self-contained satellite towns. The two express highways included in the Master Plan have been now nearly completed to serve as National Highways.

In 1938, he was deputed by the Bombay Municipal Corporation to visit foreign countries to study major engineering problems pertaining to Municipal Engineering and methods adopted for their solution. His career in the Bombay Municipal service was so successful and eventful that he is aptly described by some as the 'Architect' of Greater Bombay. He still continues to give honorary advice to the Corporation in its various engineering activities. While in Municipal service, he was Honorary Consulting Engineer to the Government of West Punjab for the water supply and sewerage scheme for its new capital at Chandigarh. He was also Adviser to the Union Ministry of Health for the water supply and sewerage schemes of Delhi following the recommendations made in the report of the Jaundice Enquiry Committee appointed by the Government of India of which he was a member.

He was a member of the Environmental Hygiene Committee and also a member of the Building Project Team of the Planning Commission. He served as Chairman of the Panel appointed by the Planning Commission for reporting on slum clearance, National Water Supply and Sanitation Schemes, refuse collection and disposal, and industrial townships. He is the Chairman of the Panel appointed by the Union Ministry of Health for preparing a Manual and Code of Practice for Water Supply and Sewerage Schemes and a member of the Panel on Housing and Regional Planning of the Planning Commission.

He worked as a member of the Committees set up by the World Health Organization for evolving drinking water standards and for reporting upon public health aspects of housing.

He has also done notable work in the field of technical education. He was a member of the Governing Body of the Victoria Jubilee Technical Institute for over 20 years, a member of the All-India Council of Technical Education, a Fellow of the Bombay University for a number of years, Chairman of the Board of Studies in Engineering and a Dean of the Faculty of Technology of that University for two consecutive years. He is a member of the Governing Body of the Visvesvaraya Regional College of Engineering, Nagpur.

He was instrumental in bringing into existence the Central Public Health Engineering Research Institute in Nagpur under the Council of Scientific and Industrial Research, and he was its first Director for three years (1958-61).

He has actively participated in the promotion of secondary education and various social and cultural activities in Bombay.

He is the author of numerous papers, monographs and reports on engineering subjects, particularly in the fields of Public Health Engineering and Town Planning.

He is a Fellow of the National Institute of Sciences of India, a Member of the Institution of Civil Engineers (U.K.), a Member of the Institution of Municipal Engineers (U.K.), a Fellow of the Royal Society of Health, an Honorary Member of the Institution of Sewage Purification (U.K.), a Member of the Association of Town Planning Officials (U.S.A.), a Member of the American Public Works Association, a Member of the American Public Health Association, and an Associate Member of the Water Pollution Control Federation (U.S.A.).

He was President of the Institution of Engineers (India) for two consecutive years in 1940-41 and 1941-42. He was a Vice-President of the Indian Roads Congress.

During the period 1959-62, he paid several visits to the U.S.A., the U.K. and Continental countries to study modern trends in public health engineering with a view to their application to suit Indian conditions. In 1955, he was invited by the French Government to inspect modern engineering works in France.

He is at present practising as Consulting Public Health Engineer. He is a Consultant to the firm of Sir Robert Bruce and Partners.'

Dr. Sen thereupon presented the Scroll of Honorary Life Member to Shri Modak. Shri Modak signed the Register of Honorary Life Members. (*Applause*)

4. Dr. Sen next introduced Prof. N. S. Govinda Rao, President-Elect, for the session 1965-66 in the following terms:

'Prof. N. S. Govinda Rao, after having obtained the B.E. degree in Civil Engineering from the Mysore University in 1928, winning both the Gold Medals of the year, joined Mysore Government service. After gaining 13 years of field experience in the design and execution of river valley projects, he commenced his research career by starting the Krishnarajasagara Hydraulic Research Station, where he worked for 7 years. For the last 15 years, he has been working as Professor of Civil and Hydraulic Engineering, which Department he started in the Indian Institute of Science, Bangalore. He has travelled widely.

To the students, he is best known as the author of a text-book on Hydraulics and as a teacher, and an examiner at B.E., M.Sc. and Ph.D. degrees of various universities.

To the research workers, he is known for his work specially in the field of hydraulics. He was the recipient of the Certificate of Merit in 1956 and the President's Gold Medal in 1961 of the Central Board of Irrigation and Power. He is the author of several papers, five other books, and some inventions.

To his colleagues abroad working in his field of specialization, he is known, apart from the papers he has published, as a member of the panel of editors of the international journal *Hydraulic Research*, and for his service for two consecutive terms on the Executive Committee of the International Association for Hydraulic Research, Delft, Holland. He presided over one of the sessions of the Conference on Fluid Mechanics held at Perth in Australia.

His engineer friends know him as a Consultant to the Government of Coorg and now to the Mysore Government in respect of all their major hydro-electric and irrigation projects and the Mangalore Port project. He is also consultant to several well known organizations in the public and private sectors.

His journalistic friends editing technical publications know him as the Chairman of the Civil Engineering Division of our Institution, and as the editor of the publications of the international symposia held every year in his department.

To us, Institution members, he is well known for his service in several capacities since he joined as a Corporate Member in 1935. He was Vice-President of the Institution and Chairman of the Mysore Centre, member of the Council, Chairman of the Civil Engineering Division, member of the Examinations Committee, member of the Engineering Research Committee, member of the Engineering Education Committee, and member of many other such committees.

He is a Fellow of many learned societies like the National Institute of Sciences, the Indian Academy of Sciences, and the American Society of Civil Engineers.

He is best known to me as a good friend and as a man who believes service to man is service to God.'

Dr. Sen then installed Prof. Govinda Rao as President for 1965-66. (*Applause*)

5. Prof. Govinda Rao said that his first duty as President of the Institution was the pleasant one of conferring the Presidential Scroll of Honour upon Dr. Sen. He thereupon presented the Scroll to Dr. Sen. (*Applause*)

6. Prof. Govinda Rao then delivered his Presidential Address (see pages 33-43).

7. Shri M. C. Chagla, Union Minister of Education, next delivered the Inaugural Address :

'It is a great honour indeed that you have asked me to inaugurate this Convention. I feel the profession of engineers is perhaps the oldest profession in the world. I am not quite sure whether it is the oldest. We have heard the old story about the controversy between politicians and engineers. The engineer said, 'I have brought order out of chaos'. The politician replied, 'Who created the chaos'? Well, I do not consider myself a politician, and I hope, I am not responsible for any chaos that prevails in this country. I concede the priority and superiority to the engineering profession. (*Applause*). It is perfectly true that it is the engineer who designs and fabricates. From the dawn of history, from the beginning of civilization, man had to design and fabricate the implements he required. When he started growing food, he had to design implements which could help him to turnover the soil and put the seed, and so on ; and, therefore, in the elementary and basic sense, in the fundamental sense, the profession of engineers is the oldest in the world. You, gentlemen, are the persons who design and fabricate. May I say that to day you duty is to design and fabricate a new society which we are trying to build up. Your responsibility is much greater. We are living in a complicated and complex society, and I think the responsibility of shaping the society, of moulding the society, of designing the society, and of ultimately creating the society, to a large extent, rests upon you, engineers. I think particularly of this Institution, it is one of the finest of its kind not only in India but anywhere in the world. Well, I know something about the United States and something about the United Kingdom. There are many engineers in both these countries, but in these countries, they have divided and sub-divided the engineering profession. Engineering like most other things in the world is indispensable, and I am glad you realize that all sections of engineering, all branches of engineering, should be brought under one roof. We are living in an age of interdependence. Whether it is in politics, in international relationship, or in scholarship, we are interdependent. The world is one and indivisible, and it is equally so in science and engineering. And therefore, I must complement this Institution which has such a representation and is such a comprehensive society. Sir, I do not accept the charge that you have made that the Government of India does not recognize this society and does not call upon it for any collaboration. Let me give you one instance. I have a certain pleasure in acknowledging that we have taken your retiring President Dr. Sen, as a Member of the Education Commission. It is a tribute to your society, a tribute to the engineering profession, and it is a definite evidence of how I feel not only of Dr. Sen but of the engineering profession. I realize that even in education you have to design and fabricate because the future of our country depends on the future of our education, and I am sure Dr. Sen, as an engineer, as an intellectual and as a patriot will help the Commission to devise a scheme of education which will help our young men to become fine citizens of our country.

Now I am very glad that the President has devoted most of his Address to the question of technical education. I attach the greatest importance to technical education in our country. We cannot progress unless we realize how important technical education is to the future generation. So far, our education has developed on formal lines. When we were young, we had only formal education, we learnt literature, history and philosophy but we did not realize the importance of technical education. We do not realize the dignity of manual labour. We do not realize that our mind should have been interrogated; we should learn not only to use our mind but also the use of our hands. I am sure there is no sector of education to which we should attach greater importance than technical education. (*Applause*). Now, in this connection, let me briefly sum up my own views on the subject. I do not pretend to be an expert. I am very much of a layman, particularly to this subject. I realize that it is important to our country. Now what we need in India is three types of engineers, and let me tell you how I divide these three categories. First, we want men right on the top, the leaders, men who will guide and mould the society. As you have said, Sir, we want engineering managers in our public corporations, in many of our colleges and institutions, and that is the trend in the U.S.A. and the U.K. Now in every society you must have leaders, you must have intellectuals; and this is all the more so in engineering education also. For that purpose, we have some of the finest institutions in India. Our Indian Institutes of Technology are intended to creat leaders in technology. We have some very fine post-graduate departments and institutes, and Dr. Sen's institution—Jadavpur University—is one of the finest engineering institutions in the country. These institutions are intended to create leaders, but we cannot have leaders only. I am sorry I mentioned only the Institutes of Technology but there are the Regional Engineering Colleges which also turn out very fine engineers.

A society cannot consist of only of leaders just as a society cannot exist without leaders. Therefore, we come to the second category, which we may call as ordinary engineers. I do not use the word 'ordinary' in a derogatory sense, but these are engineers who get their degrees and who work as ordinary engineers.

Now I come to the third category to which I attach the greatest importance. In this category, we have the greatest shortage in the country and that is of 'technicians'. What is happening in India is this : we have too many engineers and too few technicians. Engineers are working on jobs for which they are not intended, and this has resulted in a tremendous waste of engineering talent. Experts from the U.S.A. have told me that this is the only country where first class engineers are working on jobs where ordinary diploma holders should be working, and this is the one that has set frustration among engineers. Every man wants to do something creative that is worthy of his talent and qualification. There is a great wastage of engineering talent in the country. Therefore, we should have a large number of diploma holders. The other day in a meeting of the All-India Council of Technical Education we agreed that the proportion of degree holders and diploma holders should be much larger in favour of diploma holders. We want thrice the number of diploma holders than degree holders and graduates.It is for this purpose we are attaching importance to technical schools, polytechnics and professional examinations like the one which this institution is conducting. We want more and more men to go to these institution from secondary schools. I want at least 50% of these who are today going to colleges and universities to go to technical schools and polytechnics and junior technical schools and become technicians. It will help to solve a major problem of ours, that is the tremendous pressure on colleges and universities, as a result of which the standards of higher education are falling. If we have institutes where boys and girls can be trained, then there would be no need why everybody should go to colleges and universities.

One of our great difficulty today is the lack of teachers. I do not know whether you realize that in some of our best institutes today 40 to 50% posts of teachers are not filled up. Well, after all, in the ultimate analysis, the progress of education depends upon teachers, and in technical subjects like engineering where you want the best talents, a shortage of this character is calamitous. We have got to do something to solve this problem. My first suggestion is, I want our important institutions to help us to have part-time teaching. You have got, I gather, 50,000 members on the Roll of the Institution. Well, persuade some of your members, some of your able engineers to devote part of their time to teaching in these institutions. If every member devotes 3 to 4 hours. a week—some in our engineering colleges, some in our engineering institutes of technology—it will be a great help and would create a fine sense of cooperation and collaboration between the practical engineers, engineers with experience, and the students in these institutions.

The second solution to this is, we should have more collaboration with industries. Industries should also help these institutions to solve the problem of shortage of teachers. We know that in England they have the sandwich courses. Here a man works in the industry, he is permitted to go and study in institutions ; he is given special holiday and vacations so that while studying he is also learning practical work. This is one form of collaboration between industry and science and technology to which I attach great importance. Industry must realize that its advance will not be possible unless it gets the personnel, the engineers and scientists which it needs. And then, to solve shortage of teachers, starting of correspondence courses has assumed very great importance in the U.S.S.R., the U.S.A. and even in England. I hope this Institution will think about it and help us and cooperate in devising correspondence courses to help some of our boys who want to be technicians if not engineers.

I believe, Sir, you have said in your Address that 'science was the father of technology'. I am sorry, you said the other way about, that 'technology was the father of science'. You are an expert, and I hesitate to differ from you. Whatever this may have been in the past, to me, it seems 'science is the father of technology'. May I say what is technology? It is the application to practical needs, for the improvement of men, the knowledge and principles of which you come to know through the study of the sciences. Science gives you the basic principles of mathematics, physics, chemistry, biology, etc.; and the technologist knowing the words of science applies them in order to devise and manufacture things which makes the lot of man happier, more contented and more comfortable. His existence is happier far more than what it was 50 to 100 years ago. And therefore, if we want to have a technological society, if we want to participate in the technological revolution that is going on today, we have to attach the greatest importance to science. It is only through a knowledge of science that we will be able to create ultimately a technological society. That is why I am attaching very great importance to the teaching of science in our schools. When I was in school, I learnt no science. I did not know anything of the elements of physics, chemistry or biology. Today, all the world recognizes that science should begin at the earliest possible stage.

How is it that Russia in a short time has gone to the top position today? Today it is the most leading technological country in the world. Why? It is because they realized the importance of science and started teaching science to their students from the primary school. We had the other day a team of Russians with advisors and science educationists who visited our country. We have got their report—a first class report—and they have given us the advice that we should start teaching of science not from the secondary school but from the primary school. For this, we do not want laboratories, we do not want sophisticated science, glass equipments and instruments. As you have observed, Sir, we must instil in boys and girls the quality and faculty of observation. We as a nation are not successful in this since we are by nature introverts. We are not extroverts. When we walk through a street, we do not observe flowers, or the architecture of the buildings, but we are all the time thinking of our own souls and of the next world. It is time our boys and girls learned how to observe, the first prerequisite of a scientific bent of mind. Even at a school without any equipment, if you look outside, look at what is growing, look at the sun, the stars and the moon, by sheer observation, we can attribute certain laws of science with our own faculty, it could instil the scientific temperament in our children. Thus, the first quality of a scientist is the quality of observing, and the production of laws comes afterwards. Hence it is necessary that we must start teaching rudiments of science in our primary schools.

Then, Sir, you have mentioned about basic education and here I entirely agree with you. The nomenclature we give it does not matter. What we want is that our education should be production-oriented. We must have multipurpose schools where boys and girls not merely read books but produce something. There is no greater pleasure in this world than in creation. If boys and girls are asked to create something, produce something, all acts of indiscipline vanish and there will be joy in study. Why do boys and girls get bored going to our schools? It is because they feel they are not creating anything. They feel they go to school just in order to pass the examinations. But we must give our education a bias in favour of production. I am not in favour of anything in particular. Every child wants to create something, and to help him to do this, I entirely agree with the President that we should have basic institutions.

Well, Sir, I also agree with you that we should have special refresher courses and summer schools for our engineers already in employment. We must accept the position that education does not stop when we leave the schools and colleges. Education must continue throughout our life; and specially in science and engineering where knowledge is increasing so fast, we cannot afford to lag behind. A man without studying humanitie, of course, can be there but the world is progressive and he can afford but to be up-to-date. But an engineer or scientist cannot afford but to know the position of science or engineering to day and what technical advancement is being made. Those who have already risen in the profession may feel shy of going back to colleges after leaving the college and education. The times have changed now. They should not forget that it should be their constant endeavour to catch up with the latest researches and scientific knowledge. In foreign countries, you will find the top executives go from time to time to refresher courses in universities just to catch up the modern advances. Therefore, I think that in our industry, in our public corporations, it should be a part of an engineer's duty to take up refresher cources and study in summer schools so that he can keep up-to-date. I am glad to know that Dr. Sen has attached importance to this and has set up an institution for conducting refresher courses and summer schools.

Now, Sir, you have said something with which I am in entire agreement, and about which I feel very proud. We have too long depended on foreign countries for our technology, for our knowhow, for our plants, and for our designs. We are almos prevailing as if we cannot use our own limbs and have always been walking on crutches. I have no doubt in my mind that we have sufficient talent in this country (*Applause*), engineering and scientific, and all the knowhow and how they work, and yet every time when new industry has to be set up, we tend to foreign countries for collaboration which includes the knowhow. We have consultant firms which are of the best and yet we prefer foreigners' talent. What we lack today is confidence in our own men. Not that there is no talent. If we only ask, give us this knowhow, prepare and design this plant, fabricate this plant, I have no doubt that they will do it. I, therefore, feel strongly before we turn to foreign countries, ask them to give us their plans, to give us their knowhow, it is our bounden and patriotic duty to turn to our own men and ask them. In your Address, Sir, you have used a fine expression and I hope that this word will travel from here to Delhi, and that is 'we want technical *Swaraj*. We had political *Swaraj*. We had many kinds of *Swaraj*. Let us now say we want not only technical *Swaraj* but technological *Swaraj*. We were told the same thing when we were fighting for political freedom, we were asked how will we be able to manage? Where were our men and administrators? Well, we have run this country. We are being told these same things in technology. Where are technologists; how will we plan? My answer is, as we got our freedom and have been running our country, in the sphere of technology also, we must get our *Swaraj* and run our country. ourselves. Therefore, the one important aspect of the problem before us to which we must attach the greatest importance, and in fact we have done so, is to raise engineers who design and fabricate pilot plants and prototypes and invent.

I want to tell something more before I finish. Sir, you also spoke in your Address about converting our rural economy to an industrial one. That is the dream of our future. Today 80 to 85% of our men are living in villages and the land cannot stand the pressure of these men because they do not produce enough. Our economy is backward because it is largly a backward rural economy and therefore we must give to our agricultural ecnomy an industrial base. There is more than that. We want small industries to spring up all over the country. We do not want big factories and big plants in the cities, which mean urban industrialization alone. We want rural industrialization. We want men working on the farms to have small industries where they can supplement their income and lead their life comfortably. When Gandhiji spoke about *khadi*, it was not merely from an ideological feeling, but he was speaking of the

MEMBERS OF THE COUNCIL BEING INTRODUCED TO SHRI M. C. CHAGLA (UNION MINISTER OF EDUCATION), CHIEF GUEST same thing in the context of his own times. He realized the poverty of the masses, and that the farmer could supplement his income by spinning, weaving and selling yarn, so that he could earn a little more money on which he could live. Well, *khadi* is still with us but we have progressed since Gandhiji's time and today we must realize that the future of our country depends on small industries. I attach more importance to small industries than to big factories and plants because I am myself most interested in the small man, in the common man, than in the rich and the powerful industry. Therefore, you engineers are now to think in these lines—to set up small plants, to set up small factories, and to have small workshops in which our farmers can work in the off season and lead their life in the village. Gentlemen, I think the engineering profession has a great future; as I said, it is a profession to design and fabricate; our whole country depends on it. You have to design thousands of things in thousands of spheres—not only design but you are also to fabricate. Let us start designing not merely machinery and plants. As the President said, your duty is to learn how to create and help to create a new society; whether you call it a socialistic society or not, I do not care. We want a society where the standard of living of our people is raised. Our people have suffered too long in poverty, illiteracy, disease and unemployment, and it is for you, engineers, to help us in changing and making our country, which is a great country, a place where the common man, the humble man, will look up and say—'I have the dignity of a human being'.

8. Shri J. P. Mital, Chairman, Uttar Pradesh Centre, then proposed a vote of thanks to the Chief Guest, Shri Chagla, and the other guests present as follows:

At the conclusion of the Inaugural Session, Shri Mital said.

'We have just listened to a most inspiring address by our illustrious Chief Guest, Shri M. C. Chagla, Union Minister of Education. Shri Chagla has drawn our attention to many problems and made many observations which would be of interest not only to engineers but to administrators and public men alike.

In his Presidential Address delivered by Prof. Govinda Rao, he has drawn the attention of the Government to the desirability of the top secretarial and managerial posts being held by engineers. I like to recall in this connection the observations made by you, Sir, as Governor of Bombay while inaugurating the 27th Annual Meeting of the Central Board of Irrigation and Power held in Bombay in November 1956. You had then observed, 'A possible solution may be that you have have a Chief Engineer as Secretary and with him may be associated as Joint Secretary a non-technical man or a man with administrative experience'.

May we hope, Sir, that as a Cabinet Minister you will use your good offices and influence in having your views implemented.

And now it is my most pleasant duty to thank you, Sir, on behalf of the Institution and on my own behalf, for having spared the time to come and inaugurate this Convention. I also thank our esteemed guests for having come and participated in the fuctions.'

The Session then concluded at 11.45 a.m. with the playing of the National Anthem. Coffee was served in the grounds of Ravindralaya.

Eighth Sir Mokshagundam Visvesvaraya Lecture

Shri N. V. Modak, Honorary Life Member, then delivered the Eighth Sir M. Visvesvaraya Lecture at 12 noon (see pages 44-70).

Dr. K. L. Rao, Union Minister of Irrigation and Power, presided.

Upon the conclusion of the Lecture, Dr. Rao thanked Shri Modak for delivering the Lecture and complimented Shri Modak on the excellent exposition of the subject.

Shri J. P. Mital, Chairman, Uttar Pradesh Centre, proposed a vote of thanks to Dr. Rao for having kindly presided over the function and said :

'It is my most pleasant duty to thank Dr. K. L. Rao, Union Minister of Irrigation and Power, for having come and presided on this occasion, particularly after a strenuous tour.

You, Sir, have made certain observations on the irrigation and erosion problems prevailing in Allahabad region which you have just visited. It was only natural that you should have been struck by the unhappy conditions prevailing there and I like to assure you, on behalf of the engineers of Uttar Pradesh that all possible efforts will be made to take effective measures for providing irrigation facilities and anti-erosion works wherever necessary.

The meeting concluded at 1.15 p.m.

Closing Session, Tuesday, February 23, 1965

The Closing Session was held at 12.00 noon on February 23, 1965, in Ravindralaya, Lucknow. The President, Prof. N. S. Govinda Rao, was in the Chair.

Commencing the proceedings, the President said that he would request the General Reporters of the four Sessions of the Seminar on 'Technical Education and Its Development (1966-81)', and the members who took the Chairs at the meetings of the various Divisions and Groups, to give brief reports of the proceedings in the respective sessions.

(i) Dr. H. C. Visvesvaraya (*M.*), General Reporter at the First Session of the Seminar, said that the papers presented at that Session dealt with a wide range of issues and covered almost the entire field of technical education. In his General Report, he had attempted to channelize discussion on the vast subject of technical education and endeavoured to highlight those points which fell reasonably within the scope of the Session. Some of the papers were so well presented and thought-provoking that it would be necessary for members to read their full texts for their appreciation. Among the topics he had suggested for discussion were, if there should be emphasis not only on assimilation of technical knowledge which already existed but also on developing ability to modify it to meet changing needs, if it was logical and useful to divide technical education into four levels, such as the craftsman level, diploma level, graduate level and post-graduate level, flexibility in courses and in selection of subjects, need for technically competent men whose training is society-oriented, industry-oriented and job-oriented, the need for close coordination and inter-contribution between technical institutions and industries and between university research and research and development in industry, the need for modifications in teaching methods, if it was desirable and feasible to ensure uniformity in admission standards to the engineering colleges, and methods to improve discipline among students. The discussions which had taken place in this Session were both very informative and lively, and diversified views were expressed.

(ii) Prof. R. S. Chaturvedi (*M.*), General Reporter at the Second Session of the Seminar, said that he had highlighted the points made by the various authors who had contributed papers in that Session in his General Report. He had suggested some points for discussion, among which were whether or not there was a need for awarding two types of degrees in engineering, the science-oriented and the technology-oriented, if two independent curricula were necessary for these courses, specialization at the degree level, the type of practical training after graduation and how it can be achieved, the exchange of personnel from Government departments and industries with the universities and colleges, refresher courses, internal and external examinations, media of instruction at the diploma level and the degree level, text-books on engineering, and others. The ensuing discussion was extensive and brought out many points of importance which will be recorded in the proceedings of the Seminar.

Shri G. S. Ramaswamy (*M.*), General Reporter at the Third Session, was not present.

(iii) Prof. A. Lakshmanaswamy (*M.*), General Reporter at the Fourth Session, said papers presented at that Session dealt with the improvement of curricula and bringing uniform standards in the undergraduate courses, improving and equipping laboratories, postgraduate studies, practical training, employment potentials, and others. He had tried to analyze the papers in the light of the relevant importance of the topics covered by the authors and had presented certain subjects for discussion. Some of the points which were discussed at considerable length during the Session were the need for change in the present curricula in engineering, if it was necessary to make the curricula science-oriented, if there was a need for more engineers or engineer-scientists, the five-year integrated degree courses, whether or not the shortage of technical manpower was real, if it was necessary or practicable for a central authority to conduct engineering examinations, if there was a need in uniformity of engineering curricula, post-graduate courses, the link between education and industry, and wastage in technical education. The discussion of these topics was both exhaustive and informative, and many members had taken part.

(iv) Shri Dildar Husain (*M.*), who took the Chair of the Civil Engineering Division, said that the Paper Meetings in the Division commenced with his Address. In the Address, he had reviewed recent trends in civil engineering practice. He had also spoken about the present status of civil engineering in this country, the need for special study groups within the Institution, and many other aspects of interest to civil engineers. Thirty-four papers had been listed for discussion, but not all of them could be discussed at the meetings, as all the authors of the other papers had not been present, and some of the papers were transferred to the combined meeting of the two Structures Groups as it was felt that it was more appropriate that those papers should be discussed at their meeting rather than in the Civil Engineering Division. The discussions in the Division had been both instructive and informative, and he had requested the members who took part in the discussions to send their comments in writing to the Headquarters for publication.

(v) Prof. M. V. Deshpande (*M.*), retiring Chairman of the Electrical Engineering Division, said that proceedings in his Division had started with his own Address in which he had highlighted recent advances in the electrical engineering field. Ten papers had been listed for discussion, and out of these seven were actually discussed. Many questions were asked, and the discussions were varied and useful. A paper in the Nuclear Engineering Group by Shri S. K. Biswas on 'Wylfa Nuclear Power Station' had also been introduced and discussed in his Division.

(vi) Dr. S. P. Luthra (*M.*), said that he was invited to take the Chair in the Mechanical Engineering Division in the absence of the retiring Chairman, Shri T. R. Gupta. Out of the 12 papers announced for discussion, only a few were actually discussed. In the absence of the retiring Chairman of the Chemical Engineering Division, Dr. V. M. Dokras (*M.*), the paper on 'Corrosion of Metals' by Shrimati T. S. Shaha had also been introduced and discussed in this Division. The paper highlighted the importance of the subject of corrosion in engineering, and the discussion was lively.

(vii) Dr. A. K. Chatterjee (*M.*), retiring Chairman of the Electronics and Telecommunication Engineering Division, said that proceedings in his Division had commenced with his own Address. Out of the nine papers listed for discussion, eight were by non-members. He, therefore, thought it was necessary that members attached to this Division should take greater interest in its technical activities and submit more papers for consideration for publication. Although no papers were shown for discussion under the Automatic Control Group, some of the papers listed under this Division actually dealt with automatic control subjects. The attendance was encouraging, and the activities of the Division should be picking up with more papers in this wide field in which so many members were actually working.

(viii) Dr. B. V. Bhoota (*M.*), said that he was invited to take the Chair in the Public Health Engineering Division in the unavoidable absence of Shri R. S. Mehta (*M.*), retiring Chairman of the Division. In his Address, he had highlighted the activities of the Division during the preceding year at an international level. He had also referred to the symposia held at the Central Public Health Engineering Research Institute. It was gratifying that there had been a considerable increase in the number of papers received in the Division, which was steadily growing in strength. He had also spoken on the need to encourage consultants in the field of public health engineering, the ability of Indian public health engineers to contribute to the national export effort by their knowledge and services, and the need to formulate a water resources development policy. Eight papers were listed for discussion, and five were discussed. Attendance and the standard of discussion were high.

(ix) Dr. G. P. Chatterjee (*M.*), retiring Chairman of the Mining and Metallurgy Division, said that he had commenced proceedings in the Division with his own Address in which he had highlighted the problem of material technology in the country. He said this was a subject of vital importance which had not received adequate recognition. Of the five papers announced for discussion, three were discussed. These dealt with the Neyveli Lignite project in the Madras State, the promotion of safety in mines, and corrosion of metals. The attendance was good for a small Division and the discussion fruitful.

(x) Shri J. G. Bodhe (*M.*), said he was presenting the report of the proceedings in the joint meeting of the Concrete Construction Group and the Domes, Plates and Shells Group in the absence of Shri G. S. Ramaswamy (*M.*), who was not able to be present. The meeting was extremely well attended and commenced with Shri Ramaswamy's Address in which he had highlighted recent trends in structural engineering, particularly in the field of arch dam analyses by numerical methods, metric methods, use of electronic digital computers, etc. Four papers were presented, out of which three were transferred from the Civil Engineering Division. The paper readings were followed by good discussion. At the conclusion of the discussion, the Chairman was authorized to discuss with the President the following recommendation of the Group: that an attempt be made by the Headquarters to ascertain the number of engineers who are interested in Structural Engineering with a view to form a Division in this branch of engineering.

(xi) Shri S. Basu (*M.*), retiring Chairman of the Marine Engineering and Shipbuilding Group, said that attendance in his Group was very small. The proceedings commenced with his Address, in which he had dealt with the importance of marine engineering and shipbuilding to the country and the need for a planned programme to ensure security of orders for the building of ships, engines and auxiliary plants in the country. A paper by Shri S. K. Biswas (*A.M.*) on 'An Approach to Reactor Design for Nuclear Propulsion' was presented and discussed. It stressed the need for research and study through pilot plants in this country itself. Finally, there was some discussion as to how members practising in this field of engineering could become members, and it was suggested that a suitable syllabus should be prepared for inclusion in the scheme of the Institution's examinations. The Chairman undertook to do this work for the consideration of the Examinations Committee.

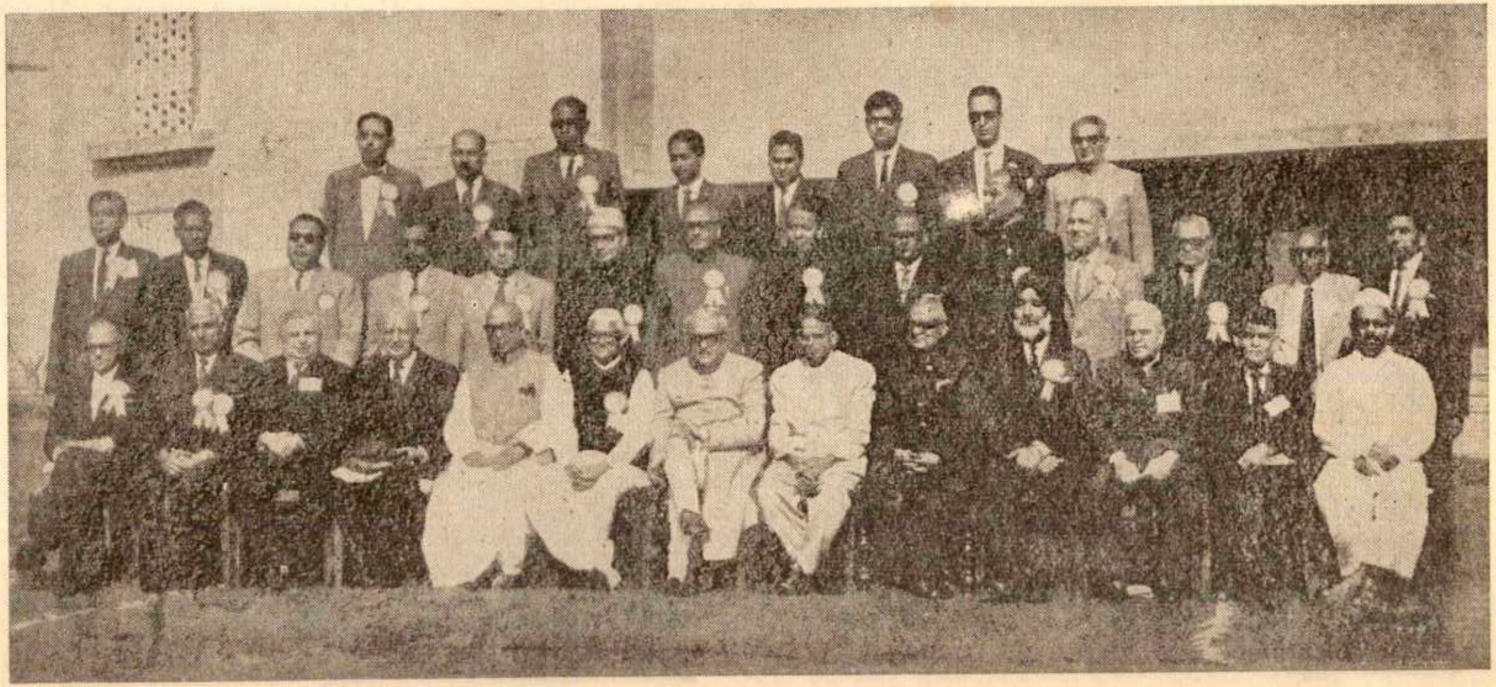
(xii) Shri D. N. Chopra (*M.*), Chairman, Railway Engineering Group, said attendance at the paper meeting in his Group was very good. Three papers were listed for discussion, but two of the authors were not present on the first day. The paper on 'Buckling of Long Welded Rails' by Shri H. Sinha (*M.*) was discussed. On 22nd February, another paper, Shri R. K. Jain's 'Survey of New Railway Lines', was discussed. The attendance was again good.

(xiii) Shri Brijmohan Lal (*M.*), Adviser, Hindi Section, said that the interest in the activities of his Section continued to be encouraging. The proceedings commenced with his own Address and was followed by the reading of a paper by Shri Viswambhar Prasad on 'Valuation of Immovable Properties'.

(xiv) Shri Dildar Husain (*M.*), who took the Chair at the Student's Session, said that the proceedings in this Session started with an Address by the Secretary, Shri B. Seshadri. This was followed by the presentation of nine papers by Students. He said he had constituted a panel consisting of Lt.-Col. R. S. Attre (*M.*), Prof. Dinesh Mohan (*M.*), Prof. N. J. Masani (*M.*), Col. S. K. S. Mudaliar (*M.*), Shri S. Panchanathan (*M.*) and Dr. H. C. Visvesvaraya (*M.*), to adjudge the papers for the award of

THE COUNCIL 1965-66

WITH THE CHIEF GUEST



Sitting : Front Row (L. to R.) K. K. Nambiar, K. N. Misra, D. P. R. Cassed, F. A. Nadirshah, Dr. T. Sen, J. P. Rawat (*Minister for Public Works Uttar Pradesh*), M. C. Chagla (*Union Minister of Education, Chief Guest*), Dr. K. L. Rao (*Union Minister of Irrigation and Power*), Prof. N. S. Govinda Rao (*President*), Maj.-Gen. Harkirat Singh, N. V. Modak, Dildar Hussain, S. B. Joshi.

Standing : Middle Row (L. to R.) S. K. Laha, B. K. Dutta, Prof. S. P. Chakravarti, G. C. Goswami, K. C. Banerjee, K. N. Rohatgi, S. N. Sinha, Prof. M. V. Deshpande, S. K. Majumder, S. Padhi, D. C. Sarma, J. G. Bodhe, Brijmohan Lal, K. C. Mital (*Chairman Uttar Pradesh Centre*)

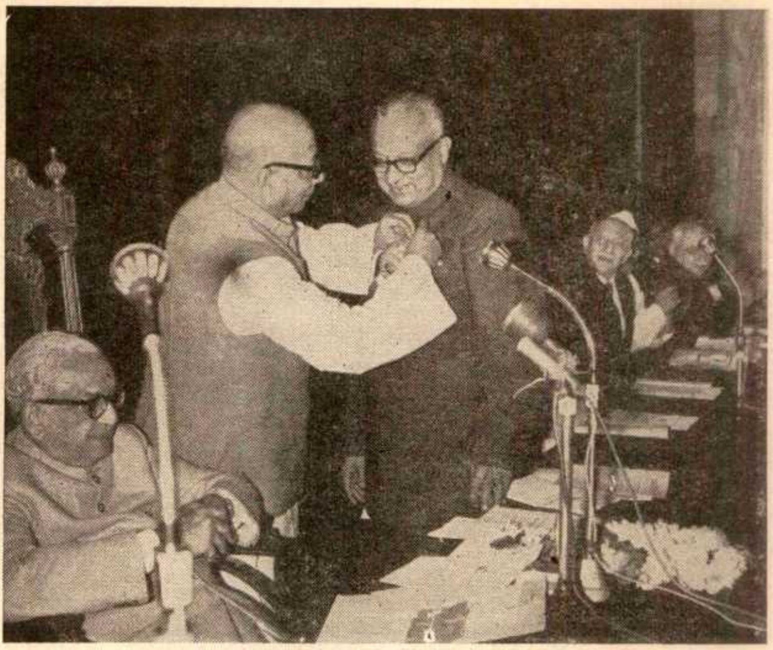
Standing : Last Row (L. to R.) K. F. Antia, Maj.-Gen. R. A. Loomba, Prof. A. Lakshmanaswamy, H. Nandy, A. C. Mathur, S. K. Mukherjee, B. Seshadri (*Secretary*), G. S. Desai

45TH ANNUAL GENERAL CONVENTION, LUCKNOW, FEBRUARY 1965

SHRI J P. RAWAT, MINISTER FOR PUBLIC WORKS, UTTAR PRADESH, WELCOMING THE GATHERING

DR. SEN PRESENTING THE SCROLL OF HONORARY LIFE MEMBER TO SHRI N. V. MODAK

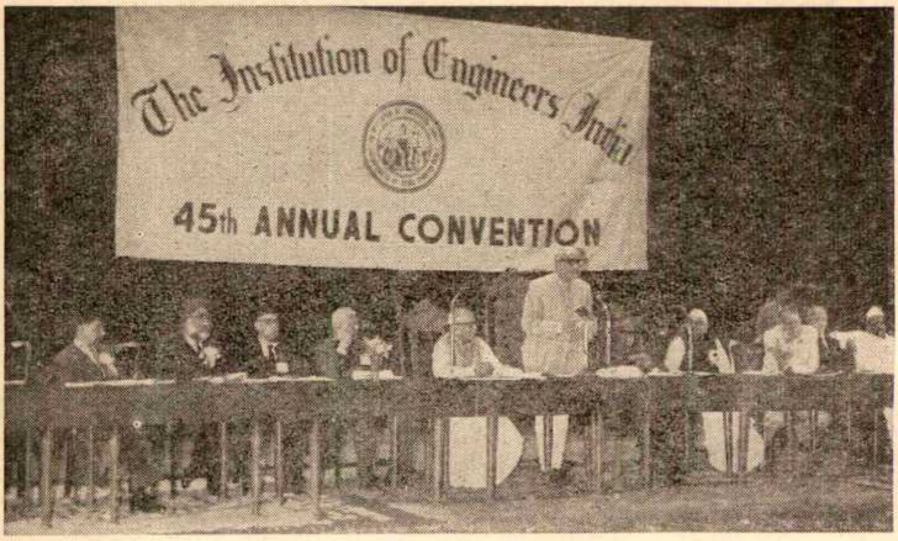
45TH ANNUAL GENERAL CONVENTION, LUCKNOW, FEBRUARY 1965



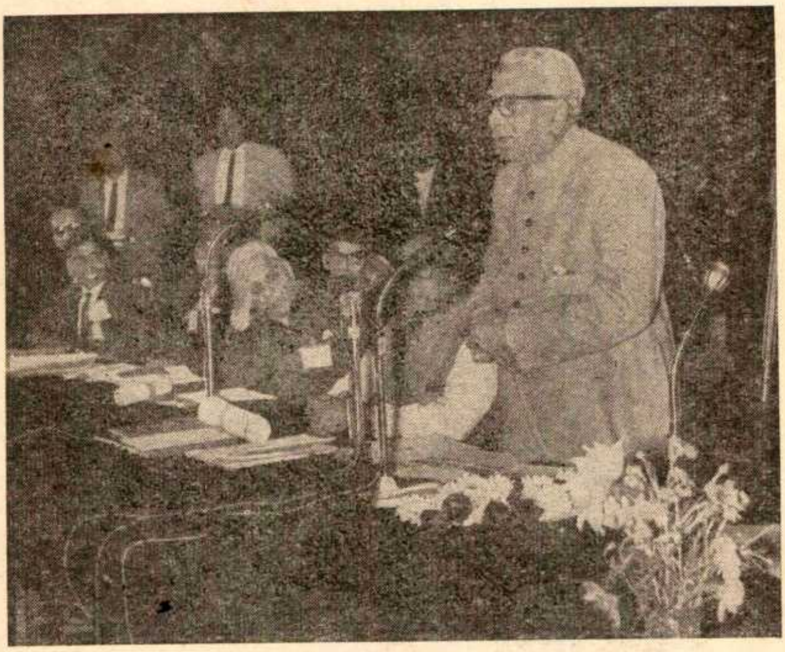
DR. T. SEN, RETIRING PRESIDENT, INSTALLING PROF. N. S. GOVINDA RAO AS PRESIDENT FOR 1965-66

PROF. GOVINDA RAO DELIVERING THE PRESIDENTIAL ADDRESS

45TH ANNUAL GENERAL CONVENTION, LUCKNOW, FEBRUARY 1965


The Institution of Engineers India
45th ANNUAL CONVENTION

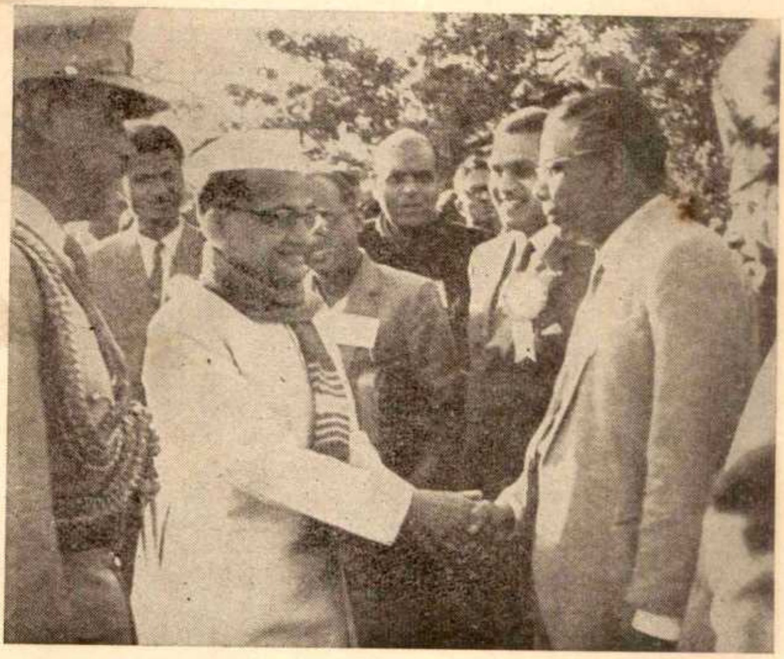
Shri Chagla Inaugurating the 45th Annual Convention



Shri Chagla Delivering the Inaugural Address

45TH ANNUAL GENERAL CONVENTION, LUCKNOW, FEBRUARY 1965

PROF. GOVINDA RAO, SHRI M.C. CHAGLA AND DR. K.L. RAO DURING COFFEE BREAK AFTER THE INAUGURAL SESSION



HIS EXCELLENCY SHRI BISWANATH DAS, GOVERNOR OF UTTAR PRADESH, GREETING THE DELEGATES AT THE AT HOME GIVEN BY HIM IN THE LAWNS OF RAJ BHAVAN prizes. After the papers were presented, the panel decided as follows: First Prize, Shri B. G. Rao and Shri Amar Singh for their paper 'Investigation on Some Aspects of Load Tests on Sandy Soils'; Second Prize, Shri B. Nagaraja Rao for his paper 'Infrared Radiation and Its Military Applications'; and Third Prize, Shri M. K. Saxena for his paper 'Recent Advances in Soil Stabilization with Lime'.

The Students then wished to speak on some of their difficulties, particularly in regard to the Institution examinations. After some time, they were advised by himself, Col. Attre and Dr. Visvesvaraya that as the Student Chapters functioned under the direction of the Local Centres, whatever the Students had to say in regard to their difficulties should be first placed before the Committees of the respective Local Centres for consideration.

(xv) At the conclusion of the above reports, Maj.-Gen. Harkirat Singh (*M.*), moved the following resolution:

'The Institution of Engineers (India) view with grave concern the continuance of Government practice of placing non-technical men at the top administrative levels of Engineering Departments both at the Centre and the States, and consider it seriously jeopardizes the success of the numerous engineering projects which are the responsibility of these Departments to execute. The Institution, further, note with considerable regret that Government have taken no notice of previous representations made in this matter both by the Institution and other technical bodies over a period of years, which, in their opinion, has directly led to many plan failures and disappointments.

The Institution, therefore, wish to impress on the Central Government that this situation should be rectified at once by making a beginning in this direction by appointing engineers as Secretaries to the Central Ministries of a technical nature, for example:

Ministry of Irrigation and Power
Ministry of Steel
Ministry of Industry and Supply
Ministry of Works and Housing
Ministry of Oil and Petrochemicals,

and as Managing Directors of Public Sector Undertakings. The Institution, at the same time, wish to convey the same impression to the State Governments for action regarding similar Ministries in the States.

The Institution wish, also, to impress on the State Governments that they should initiate similar action by appointing engineers as Heads in the Public Sector Industries, Chairmen of Electricity Boards and such other posts.'

This was seconded by Shri D. P. R. Cassad (*M.*).

Shri N. G. Mahalingam (*M.*) said that while he agreed with the object of the resolution which had been moved, he objected to the remarks made on the administration of the country.

The President then put the resolution to the house, which was adopted unanimously.

(xvi) Dr. T. Sen (*M.*) then moved the following resolution. This was seconded by Shri D. P. R. Cassad (*M.*):

'The Institution of Engineers (India) places on record its deep concern at the recent shift in Government policy whereby design and engineering of major projects are being handed over to foreign agencies when the necessary expertise exist within the country.

The Institution would like to draw the attention of Government to various recent statements of the Planning Commission, such as its Memorandum on the Fourth Five Year Plan, and the Economic Policy Resolution of the Durgapur Session of the Congress, both of which attach special significance to the need to develop competent Indian design and engineering organizations for constructing our national projects. Self-reliance in technology and equipment manufacture has been for long the declared objective of Government policy which has been proclaimed in the Lok Sabha as well as in public statements on numerous occasions. Any retreat from this concept is likely to undermine the morale of our engineers and their faith in Government's utterances and promises.

The Institution further desires to express its concern that under the guise of 'training' our engineers and 'associating' them with foreign collaborators, major design assignments are being awarded to foreign agencies for which competent and experienced Indian engineers are already available. Indian engineers do not seek mere association without responsibility, but the opportunity to do responsible work as an engineering team.

The Institution is firmly of the opinion that only the development of Indian technical knowhow can provide the broad industrial base for the country's rapid economic progress. To this end, the Institution urges the Government to reconsider its policy so as to give significant scope in the Fourth Plan itself for Indian consultancy services to take their rightful place in the planning, design and installation of the country's industrial projects.'

Maj.-Gen. Harkirat Singh (*M.*) then moved the following amendment:

'The Institution of Engineers (India) places on record its deep concern at the recent shift in Government policy whereby design and engineering of major steel and other projects are being handed over to foreign agencies when the necessary expertise exists within the country.

The Institution would like to draw the attention of Government to various recent statements of the Planning Commission, such as its Memorandum on the Fourth Five Year Plan, and the Economic Policy Resolution of the Durgapur Session of the Congress, both of which attach special significance to the need to develop competent Indian design and engineering organizations for constructing our national projects. Self-reliance in technology and equipment manufacture has been for long the declared objective of Government policy which has been proclaimed in the Lok Sabha as well as in public statements on numerous occasions. Any retreat from this concept is likely to undermine the morale of our engineers and their faith in Government's utterances and promises.

In this connection, the Institution is particularly distressed at the unfair treatment meted out to the Indian Consultants, M. N. Dastur & Co. Private Ltd., on the establishment of the Bokaro Steel Project. Indian engineers had noted with great pride the growth of this firm to one of the largest steel plant consulting organisations in the world. The Institution was particularly gratified that Government signed an Agreement entrusting the design and engineering of the Bokaro project to this firm.

It is therefore a matter of great regret that the commitments made and assurances given are not being honoured, and that the splendid opportunity which Bokaro would provide for the development of Indian engineering is being irretrievably lost.

The Institution further desires to express its concern that under the guise of 'training' our engineers and 'associating' them with foreign collaborators, major design assignments such as Bokaro and the Fifth Steel Plant (Anglo-American Consortium) are being awarded to foreign agencies for which competent and experienced Indian engineers are already available. Indian engineers do not seek mere association without responsibility, but the opportunity to do responsible work as an engineering team.

The Institution is firmly of the opinion that only the development of Indian technical knowhow can provide the broad industrial base for the country's rapid economic progress. To this end, the institution urges the Government to reconsider its policy so as to give significant scope in the Fourth Plan itself for Indian engineering sevices to take their rightful place in the planning, design and installation of the country's industrial projects.'

The President put this amendment to the house. It was lost by an overwhelming majority.

Then the President put the original resolution to the house. It was passed by an overwhelming majority. He then announced the resolution as proposed by Dr. Sen and seconded by Shri Cassad as carried.

(xvii) Col. S. K. S. Mudaliar (*M.*) said that he would like to mention to the house that the subjects covered by the two resolutions which had just been adopted by the house had also occupied the attention of the Council of the Institution of Surveyors (India), of which he had the honour to be the President for the year. He said he would like to assure the house that that Institution held exactly similar views on the subjects as the Institution of Engineers (India) and fully supported the efforts made by the Institution of Engineers to achieve technical leadership of engineering undertakings and projects.

The President thanked Col. Mudaliar for his assurances on behalf of the Institution of Surveyors (India).

The President then concluded as follows:

'I have now the very pleasant duty of extending our warmest thanks to the Uttar Pradesh Centre for acting as hosts on the occasion of this, the 45th, Convention and for their hospitality during the last few days. Our appreciation has to be given in a double measure particularly as the arrangements have been very elaborate and thorough. I also understand that the registration has been an unprecedented one, perhaps as a result of additional members and guests attending the Seminar on 'Technial Education and Its Development'. This had somewhat complicated arrangements at the very last moment.

I wish particularly to mention the names of Shri J. P. Rawat, Minister of Public Works and Chairman of the Reception Committee (*Applause*), Shri K. N. Misra, Past-Chairman of the Uttar Pradesh Centre who invited us to Lucknow for the Convention (*Applause*), Shri J. P. Mital (*Applause*), Chairman of the Uttar Pradesh Centre, Shri A. C. Mathur, Honorary Secretary (*Applause*), and Shri Mahabir Prasad, Organising Secretary (*Applause*). The work of organising the Convention was carried on under the inspiration and personal guidance of Shri Mital, ably supported by Shri Mathur and Shri Prasad. Our thanks are also due to the Convenors and members of the Accommodation, Annual Dinner, Budget and Finance, Cultural Programme, Meetings, Publications, Public Relations, Railway Reservation, Registration, Student Chapter, Transport and Visit Committees, who are responsible for the various arrangements under these heads. (*Applause*)

Our special thanks should be given to Shrimati T. A. Rao and Shrimati Prem Manohar, Convenors of the Ladies Committee, and other ladies in that Committee who have so kindly and generously looked after the visiting ladies, shown them round this beautiful city, taken them to shopping centres, and otherwise entertained them. (*Applause*)

I wish to particularly express the thanks of the Institution to His Excellency the Governor of Uttar Pradesh for the At Home given to delegates at Government House on the 21st, the Government of Uttar Pradesh for their Dinner on the 22nd at Ravindralaya, and to the Mayor of Lucknow for the At Home to be given at the Corporation Grounds this evening. (*Applause*)

I have also to thank the Modern Engineering Works, Mohanth Singh & Sons, Varanasi Agrind Fabricators, S. B. Joshi & Co., The Indian Cable Co. and United Provinces Commercial Corporation (P) Ltd., for their at Home on the 20th, lucnh on the 21st, cocktail party on the 21st, lunch on the 22nd, At Home on the 23rd, and lunch on the 23rd respectively. (*Applause*)

I must also express grateful thanks to the Government of Uttar Pradesh for all the facilities they so readily extended to the Uttar Pradesh Centre of the Institution which primarily make it possible to made all these extensive arrangements for such a large scale Convention. (*Applause*)

I am sure all of you enjoyed the Dance on the 21st evening, and the play 'Bhai ka Pyar' last evening. Our special thanks are due to the author of the play, Shri D. N. Sanyal, who also took immense trouble in staging it. (*Applause*)

A number of Local Visits are being arranged this afternoon and tomorrow morning, and on your behalf I must express our thanks to the authorities of the Railway Design and Standard Organisation. During the Outstation Tours which will commence from this evening, many facilities for the visiting delegates will be extended by those in charge of the Heavy-Electricals Plant at Hardwar, the Antibiotics Plant at Rishikesh, the Yamuna Project Works, the Forest Research Institute, the Survey of India, the Amitam Textile Mill at Dehra Dun, the Churk Cement Factory, the Obra Thermal and Hydel

Project, the Aluminium Factory at Rihand, the Rihand Dam, the Railway Locomotive Works at Varanasi, the Banaras Hindu University and the Engineering College there. I would like to thank them in advance for these courtesies. (*Applause*)

Last but not least, I would like to express thanks to the Motilal Memorial Society for giving us the use of Ravindralaya and for allowing the use of its lawn. (*Applause*)

Shri Mital, thanking all those who helped to make the Convention a success, said:

'I feel overwhelmed by the many kind words and sentiments expressed by our President on behalf of our guests in regard to the arrangements made for this Convention by the Local Centre; the more so as I am quite conscious of our failings and inadequacy of the arrangements in many respects.

Lucknow is a small place and does not have the advantage or facilities and ammenities available in big cities like Bombay, Calcutta, Hyderabad, etc. and much as we wished, we were not able to cater to the needs of all of you as well as we should have. Still I would like to assure you that whatever inconveniences were caused to any of you or whatever facilities we could not provide was not due to any lack of will on our part but only due to our limitations and you may say, our inefficiency.

To our President, Prof. Govinda Rao and our retiring President, Dr. T. Sen, I am particularly grateful for the guidance and encouragement they have been giving to all of us during the Convention.

While thanking you all for your generous cooperation in making this Convention a success—if it has been a success, I crave your indulgence to forgive and forget our failings and shortcomings and to carry with you only the pleasant impressions of your short stay here. And I promise you to provide much better arrangements including *Qawwali*, which I know many of you missed this time, when you decide to hold the Convention here again.

I hope those of you who are participating in the study tours will find them useful as well as enjoyable.

I wish you all a comfortable return journey and thank you once again.'

Social and other events

Annual Dinner

The Forty-fifth Annual Dinner of the Institution was held on Sunday, 21st February, 1965, in the grounds of Ravindralaya, Lucknow. His Excellency Shri Biswanath Das, Governor of Uttar Pradesh, was the Chief Guest. Many guests and over 400 members attended the Dinner.

After the Dinner, the President, Prof. N. S. Govinda Rao, requested the guests and members to rise and drink a Toast to the President and the Republic of India.

The President, Prof. Govinda Rao, also proposed a Toast to the Chief Guest. Shri Biswanath Das replied to the Toast.

Shri J. P. Mital, Chairman, Uttar Pradesh Centre, proposed a Toast to 'Our Guests'.

Finally, a Toast to the Institution was proposed by Dr. A. V. Rao, Vice-Chancellor, University of Lucknow. Dr. T. Sen, Immediate Past-President, replied on behalf of the Institution.

Students' Session

The Students' Session was held on the evening of February 20. About 110 Students and other members attended. Shri Dildar Husain (*M.*), Past-President, was in the Chair.

The proceedings opened with an Address by the Secretary, Shri B. Seshadri, in which he said all students of engineering, among them the Students of the Institution, could be the ones to enrich the country's future beyond all others through the peaceful use of natural resources for the needs of her people. He described the many fields of engineering development, and the diversified opportunities that were before the Students in the years to come.

The Chairman constituted a panel consisting of Lt.-Col. R. S. Attre (*M.*), Prof. Dinesh Mohan (*M.*), Prof. N. J. Masani (*M.*), Col S. K. S. Mudaliar (*M.*), Shri S. Panchanathan (*M.*), and Dr. H. C. Visvesvaraya (*M.*) to adjudge papers for the award of prizes. Ten papers were presented, and the panel decided on the awards as follows : First Prize, Shri B. G. Rao and Shri Amar Singh for their paper 'Investigation on Some Aspects of Load Tests on Sandy Soils' ; Second Prize, Shri B. Nagaraja Rao for his paper 'Infra-red Radiation and Its Military Applications' ; and Third Prize, Shri M. K. Saxena for his paper 'Recent Advances in Soil Stabilization with Lime'.

The Students then wished to speak on some of the problems which faced them. Replies were given by the Chairman and the Secretary. They were advised by the Chairman, Col. Attre and Dr. Visvesvaraya that as the Student Chapters work directly under the supervision of the Local Centres, the appropriate way of representing their difficulties would be for the Students to place them before the Committees of the respective Local Centres for consideration.

Popular Lecture by Shri S. K. Biswas

A popular lecture on 'Some Engineering Aspects of the World's Most Powerful Nuclear Power Station—Wylfa' was delivered by Shri S. K. Biswas at Ravindralaya on the forenoon of February 23, 1965.

'At Home' by the Modern Engineering Works

An 'At Home' was given by the Modern Engineering Works to the delegates in the lawns of the Central Drug Research Institute on the evening of February 20, 1965.

Lunch by Mohanth Singh & Sons, Varanasi

Messrs Mohanth Singh & Sons, Varanasi, gave a lunch to the delegates in the grounds of Ravindralaya on 21st February, 1965.

'At Home' by the Governor of Uttar Pradesh

His Excellency the Governor of Uttar Pradesh gave an 'At Home' to the delegates in the lawns of Raj Bhavan on the evening of 21st February, 1965.

Cocktail party by Agrind Fabricators

A cocktail party by Agrind Fabricators was given on the evening of the same day.

Dance by Shrimati Sitara Devi

A dance performance by Shrimati Sitara Devi of Bombay was arranged by the Uttar Pradesh Centre for the entertainment of the delegates at Ravindralaya on 21st February, 1965.

Lunch by S. B. Joshi & Co. Ltd., Bombahy

S. B. Joshi & Co. Ltd. gave a lunch to the delegates in the grounds of Ravindralaya on 22nd February, 1965.

'At Home' by Indian Cable Co.

Another 'At Home' was also given to the delegates by the Indian Cable Co. in the grounds of Ravindralaya on 22nd February, 1965.

Dinner by the Government of Uttar Pradesh

The Government of Uttar Pradesh gave a dinner to the delegates in the grounds of Ravindralaya on 22nd February, 1965.

Play on 'Bhai ka Pyar' by Shri D. N. Sanyal

A play 'Bhai ka Pyar' written by Shri D. N. Sanyal (*M.*) was staged for the entertainment of the delegates at Ravindralaya on 22nd February, 1965.

Lunch by United Provinces Commercial Corporation (P) Ltd.

Another lunch was given by the United Provinces Commercial Corporation (P) Ltd. in the grounds of Ravindralaya on 23rd February, 1965.

'At Home' by the Mayor of Lucknow

The last of social functions of the Convention was an 'At Home' given by the Mayor of Lucknow in the Corporation grounds on the evening of 23rd February, 1965.

Local Visits

A number of Local Visits were arranged by the Uttar Pradesh Centre and the delegates were taken round to see the famous historic places of Lucknow. Special visits were also arranged to the Railway Design and Standards Organization in Alambagh.

Study Tours

Two Study Tours were arranged at the conclusion of the Session. They were :

Tour no. (1) : Heavy Electricals (India) Ltd. and Ganga Canal Headworks at Hardwar ; Hindustan Antibiotics Ltd. at Rishikesh ; Yamuna Hydel Project at Dakpathar ; Forest Research Institute, Survey of India and Indian Military Academy at Dehra Dun ; and the Sahasradhara sulphur springs.

Tour no. (2) : Rihand Dam, Cement Factory and Aluminium Factory at Pipri ; the Ghats and Locomotive Factory at Varanasi ; the Banaras Hindu University ; and Sarnath.

The delegates left Lucknow on 24th February, 1965, and returned to Lucknow on 25th and 26th and dispersed to their respective home stations.

PROF. N. S. GOVINDA RAO, M.I.E.
PRESIDENT 1965-66

PRESIDENTIAL ADDRESS

' Shri Chagla, colleagues in the profession, Ladies and Gentlemen,

At the very outset, I must express my grateful thanks to my brother members of the Council for having elected me as the President for this year. At this moment, I cannot but recall the names of the galaxy of engineers who have previously adorned this Chair bringing honour and glory to our Institution. President after President has expressed that this is the highest honour for an engineer in our country. This recollection of the past and the sentiments expressed therein brings home to me my own smallness. I feel humble. But then, thanks to the unstinted efforts of thousands and thousands of Corporate Members, the Institution has today attained a stature worthy of its gigantic size in the world of engineering. The President is like a stone on the peak of a mountain. Its presence at the top has no special significance as it is in no way different from the others. It happens to be there because it has the support from all the others below it. It is in this spirit that I accept this office. I look forward, sirs, to your continued cooperation in an even greater measure to serve the millions of our poor brothers in the country by raising their standards of living, by taking to them the benefits of our technical knowledge.

I will begin with talking about our own affairs. The elections under the revised constitution have been held both at the Headquarters and the Local Centres. Division Boards in all the seven Divisions of engineering were formed and have started functioning. The formation of these Boards, should be considered a historic event—an important milestone in the history of our Institution. These Boards are autonomous in their technical activities. The Institution today may be regarded as a Federation of Institutions functioning separately for each branch of engineering. Engineering and science are developing so fast, both in their intensity and diversity, that not only the barriers between them but even within them have crumbled. This has now been recognized by the technically developed countries in the West. Steps have been taken or in progress to bring about unification of the activities of the many separate Institutions in their countries. This is an extremely difficult problem, as unification means surrender of the independence of each one of the joining units. Prestige, tradition, and a host of other factors inhibit progress towards unification. To unite to gain strength is difficult, to divide to weaken is easy. Fortunately, in our country, our engineers in the past had the vision to foresee these difficulties and boldly decided to have only one Institution to represent all branches of engineering at the very outset. It is most important that we preserve this unique heritage of ours, and further strengthen our solidarity in the years ahead, if we desire to keep pace with modern advances in technology. Nothing is gained by weakening this structure. I earnestly plead to the Institutions working outside of us to consider seriously the consequences of working in isolation and the advantages of working in unification with us. We are happy that the Mysore Engineers' Association which was in existence for a hundred years, merged into our Institution last year. Like the mother who is ever ready to take her children to the fold, the Institution not only welcomes but earnestly desires that the others should follow suit and come to us.

It is usual on this occasion for the President to devote the major part of his address to a particular topic of his choice. Today, I shall speak on 'What factors should govern the philosophy of development of engineering education in our country'.

The first factor to be considered is obviously the one of history. You cannot formulate a policy in a vacuum completely divorced from the past. 'Engineering traces its beginnings almost to the dawn of human existence on this planet and would embrace the craft of the prehistoric hunter and his primitive attempts to make and use weapons. It would cover the endeavours of man to master the materials available, from the Stone Age onwards, to direct the resources of nature to his own use and benefit. Throughout this long period of development, science, which is the understanding of the basic principles, played but a small part. Knowledge, largely gained from experience, was passed from generation to generation, mainly through a priestly caste.' (*Technical Education* by P. F. R. Venables, G. Bell and Sons Ltd., London, page 25). This has been so in every country of the world including ours. Technology is the father of science.

The second factor to be considered is, to my mind, the most important one. It is that we should link every one of our national activities whether it is in the field of education, technical development, generation of power, irrigation, agriculture, or any other activity to the declared objective of our Government which is to build up a socialistic pattern of society. Every national activity should be construed as but one more link in the long chain forged for lifting high our standards of living. It should be based on increased production realized through *the use of modern science and technology* and on equitable distribution of income and wealth. Any scheme of technical education we propose should, apart from being suitable for all levels of general education, also directly promote technical development. The consequence of the scheme of technical education we frame should result, in a few years, in producing all the technical personnel necessary for achieving the targets laid down in the successive Five Year Plans, in respect of (i) increase in productivity, (ii) rise in income and living standards, (iii) diversion of a large number of agricultural labour, unemployed and underemployed, to more gainful employment in industries, (iv) elimination of the dependence on more advanced countries for equipment and technical knowledge, and (v) increase in rate of economic growth. Unlike general education, technical education is purposeful. In our socialistic pattern of society technical education should be such as to contribute largely to maximization of material benefits to all, rich or poor, in the country. Everyone should have more of food, clothing, housing, and all that make living more comfortable. People have suffered from poverty for centuries. They cannot wait any longer. The breaking point has been reached. It is imperative a shift is made in the policy of development of education—giving technical education at all levels topmost priority. This should be done quickly—not quickly but immediately.

A history of the development of neighbouring countries like Japan, Russia and others shows that they began their development by giving all emphasis on technical development—in designing and fabricating equipment either based on prototypes purchased from the more developed nations or based on the application of technical knowhow published in the current literature of those nations. The country cannot afford to wait for science in our institutions to develop sufficiently to give a lead to technical development. Development of basic and fundamental research in the pure sciences has to be on a scale smaller than technical development in the context of the conditions existing today in our country. The decision of the University Grants Commission to deploy their meagre resources in fostering one or two schools of research in each of the universities is a step in the right direction.

Having settled the objectives to be achieved and the priorities in educational development, the next factor to be considered is the choice of the personnel at the top level to guide and supervise implementation of the policies. In selecting the personnel it should be remembered technical development and technical education are like Siamese twins. Separate one of them, the other will die. These twin problems have necessarily to be handled by men qualified to do so. Who are they, if they are not engineers ? It is strange that this obvious truth has been missed. What results can be expected if, for example, you go and consult a physicist, however eminent in his own field he may be, on the matter of developing, designing or purchasing an aeroplane. He may not even know the names of the parts of an aeroplane. This is true of any machine, any equipment used either in national defence or in industry, either in the public or the private sector. This seems even more extraordinary when the Government do have first-hand experience of success in employing engineers in schemes of technical development like the nuclear plant in Trombay, the antibiotics plant in Pimpri, Bharat Electronics and the Indian Telephone Industries in Bangalore, and a host of others. In the private sector there are innumerable examples. We are fully aware that our popular democratic Government has never worked in isolation, forcing their decisions on an unwilling people as it happens in dictatorial governments. They have always sought advice from persons in their individual capacities. This system has its own merits and demerits. Its greatest demerit is that the selection gets confined to a few—in fact, to a very few who dominate practically all important committees in the Government. May I suggest for the serious consideration of the Government that they should not merely confine their selection to persons who are personally known to them and who act in their individual capacities, but also invite nominations from a representative Institution like ours. It is in this way that they can come in contact with new talent. This gives them, eventually, a wider choice for selection. The Institution will form its own committees representative of the thousands associated with it and select their leaders to voice their opinion on the Government committees. In this way, Government will get to have a first-hand knowledge of the thinking of the thousands who are affected by their decisions. A high level policy making statutory or advisory body is the first requirement. Its functions have to be to coordinate technical development and technical education. It has to guide collection of data with regard to technical manpower requirements of all categories, and also to get the progress in all aspects of technical education periodically evaluated. It should lay down broad principles for recruitment of teaching personnel, training of students, writing of text-books, and encourage promotion of research for increasing efficiency and diversification of courses of technical education periodically in step with the advances made in industrial development in our or in other countries. It should ensure maintenance of proper standards. Its many other functions are to be discussed at the Seminar on Technical Education being held now.

The next problem is to work out the details of development of technical education at all levels. We may as well start from the highest level—training of the management engineer.

It is no exaggeration to state that the technical development of a country depends entirely on the quality of the leaders who manage the industries. How important they are now and will be in the future can be gauged by what is happening in other countries. '...... the research department of *Scientific American* magazine has documented just how dramatic the rise of scientists and engineers in American industry has been. The findings emphasize, also, how fast it is likely to continue to be. Between 1947 and 1963, there was a slight but significant drop in the number of production workers. Yet during that period, industrial output rose by 86 per cent. Employment of scientists and engineers in industry more than doubled. During the first half of this century, the percentage of top U.S. management executives with scientific or engineering degrees grew from 6.8 per cent to 20 per cent. By 1963, it had reached 36 per cent.' (*The Economic Times*, Bombay, 2nd January, 1965.) What is true of the United States today will be true of us in the next few years. If we have to meet the demand then, the training of such engineers should begin now. Separate courses leading to conferment of post-graduate degrees in top management for persons with an adequate background of theoretical and practical knowledge of science and engineering have to be evolved. Those who have gained experience by dint of self-study and work in high managerial positions are a very valuable asset to the country. They should be gainfully employed in management of large engineering complexes (group of industries of an allied nature) like river valley projects, iron and steel projects, heavy machine building industries, and so on. In addition, their advice will be of great value to those who have to take policy decisions and implement them. It is unfortunate that while in other countries their value is getting increasingly recognized, they are in our country mostly relegated to second-rate positions. It is a matter of great pride and satisfaction to us that wherever technical men have been assigned top administrative and managerial positions, they have acquitted themselves brilliantly. At this moment, dozens of names are crowding into my memory. The most illustrious of them all is that of Dr. K. L. Rao, Minister for Irrigation and Power, and one of our distinguished Past-Presidents. It is high time that, if we mean serious business about technical development of our country, important positions which require rich and varied experience in administration coupled with a specialist knowledge of science or technology, like Secretaryships of engineering departments, Chairmanships of Boards of Management of industries, of electricity and of transport and other undertakings are assigned to men who have adequate knowledge of *both management and technology,* and not either the one or the other.

The second category who can actively promote development of technology are the engineer-scientist research workers. These are the men who can give a lead and a direction to technical development. The number required for this work is few but then the quality of work they do, either in the pure or the applied sciences, has to be of the highest order. The training of these men, leading generally to a doctoral conferment or a post-doctoral award like the Fellowship of a learned society, has to be in institutions specially created for this purpose. Engineering graduates will have to take basic courses in the pure sciences, and science graduates will have to take basic courses in engineering, before commencing a research career in this field. These are exclusive of those specializing in the basic sciences in the universities and allied institutions.

At least ten times the number of the second category required are the design and development engineers. The training of these men should be such that at the end of their training they are in a position to design and develop either independently or working in a team, either entirely new equipment, based on the technical knowhow in the published literature on the relevant subjects, or successfully copy and/or improve prototypes of equipment imported from abroad. This work in the present context of our development is so important that, like the Russians, we should offer special courses for this purpose leading to conferments of both Master's and Doctoral degrees, as also awards of Fellowships of learned societies. This is the category who will in a large measure be responsible for reducing if not eliminating our dependence on foreign 'knowhow'. A few of these should later get trained in the plants to work as consultants for starting big industrial projects.

An equally important category, is the industrialist engineer, whose number may easily be ten times the previous type. These men are to be trained for starting, developing and managing small-scale engineering industries, and courses leading to conferment of degrees have to be organized for this purpose.

Next comes the category of erection engineers specialized in the construction, management and operation of engineering complexes like multipurpose river valley projects, steel projects, heavy electrical projects, and so on. Various types of engineers who have fairly good knowledge in civil, mechanical, electrical, and other branches of engineering as we turn out from our colleges today are required to work individually or in a team with others. Training for these will have to be necessarily broad-based, perhaps with more accent on the practical side, than what we are having now. The number required of this type has necessarily to run to thousands.

Five or six times this number required are the technicians of the foreman type for erecting, operating and maintaining small groups of equipment. They should have perfect familiarity with the operation and maintenance of all the equipment they handle, coupled with intimate knowledge of the knowhow of erecting them. The present diploma courses are too general in their content with undue emphasis on the theoretical side. The number of courses offered now may have to be multiplied many-fold and accent given more on practical training. In addition, it is absolutely essential that these men have intensive training for at least two years leading to a degree in the plants or projects where they have to start and continue their professional career.

There will generally be at least a dozen skilled craftsman for every technician. These are the experts who can make any or all the components of an equipment or a structure. Technical development to a very large measure depends on the skill of these men. They form the foundation on which technology is built. The training given to them has necessarily to be thorough. Since these form the army of technical manpower of the country, careful and detailed planning is necessary for deployment of these forces in the required numbers, for the required types of jobs, to secure optimum efficiency in their utilization. This problem of training skilled craftsmen is interlinked with the problem of creating gainful employment and preventing underemployment of the vast manpower available in the country. New nomenclatures for the courses like management engineer, engineer-scientist research worker, design and development engineer, industrial engineer, erection engineer, technician and craftsman have been deliberately given so that the students taking these courses are psychologically prepared for the avocation they are to follow at the end of their courses. Employers can also easily pick the type of persons they want.

The last and certainly not the least is the category of persons who are generally classed as uneducated, defining education as the ability to read and write. The peasant who carries on with his wooden plough, the bullock-cart driver, the village carpenter, the blacksmith, and such others form this category. Technical education has to be carried to these people by suitable planning of extension work necessary for this purpose. There are many other categories of technical personnel who are required only in small numbers. They are not discussed here.

The next aspect for the policy maker is to consider how best the development of technical education can grow in the soil as it is today. Does it require the aid of fertilizers to increase its productivity ? If so, what should be their constituents, the dose, the manner and the timing at which they are to be applied. These I shall now discuss.

The foremost one to be considered is that of finance. We cannot forget, in this context, that in 1962-63 our national income was Rs. 13,370 crores, and the per capita income was Rs. 294.7, and the number of schoolgoing children was 54.4 million. A very optimistic estimate would be to assume that these figures will get doubled by 1981-82. It is clear from this survey that our resources are poor and will continue to remain so, as rise in our national income will not be very much more than the increase in our population. Any proposal of a revolutionary character is out of the question. Psychologically also it is bad. Every change in policy we make should be such that its objectives are clearly defined and understood by the persons who are to give effiect to it. In other words, the training of persons of the various categories mentioned above should be brought about with minimum additional recruitment of teaching staff. buildings and specially equipment involving foreign exchange. Consolidation and reorientation of our existing institutions will have to take precedence over expansion during the next few years at least.

The next impediment to the execution of our policy is the low value attached to the training given in technical institutions. A student trained for three years in a junior technical high school after completing his seventh standard in a primary school, instead of being preferred for admission to a diploma course in a polytechnic because of his background knowledge of technology and technical skill in the crafts, is actually denied admission! The boy, unaccustomed to any hard work from the general high school is not only chosen but is actually preferred to the other type on the ground that he is good in the knowledge of the basic sciences. We are prepared to spend a good amount of money and labour in training this boy to acquire technical skills. If this is possible, I cannot understand why it should not be possible to spend a much lesser amount of money (training in the basic sciences costs less than training for the skills) to impart the necessary knowledge of the basic sciences in the same time now taken up for training the science boy to acquire technical skills. The same is true of the diploma students. They are denied admission to the graduate courses. No attempt has been made to give training to the diploma boys in the basic sciences in the same or probably less time and money now spent on training the P.U.C. boys in acquiring the technical skills. All that is necessary to effect this change is to redraft the present syllabi. When once this is done, its effect will be immediate. It will revolutionize the pace of our technical development. The first reaction to this important reformation is technical training will gain respectability while it has none now. When it is known that students with technical training are preferred in the matter of admission to the diploma and degree courses, hundreds of thousands of lads anxious to have a technical career will join these courses at the craftsmen levels. The better ones amongst them can easily advance their technical attainments step by step. Those who cannot get admission need not join the army of the unemployed but immediately start earning their bread by the skill they have acquired. Today, there is great frustration amongst S.S.L.C. and P.U.C. students who are unable to get admission to technical institutions. The army of these unemployed is growing and their frustration is increasing. The change now suggested is not to completely shut out the admission of the boys with general training but only to give second preference to them in the matter of admission. In many countries, this is being done. Previous training in factories is insisted upon. In some countries sandwich courses have been started.

Technical education projects can succeed only in an environment congenial to its growth. At present, young children in their classes read books on general science which adults find difficult to understand. No wonder the science subjects are very distasteful to our children. These text-books have to be rewritten emphasizing mostly the applications of science like use of electric power for domestic lighting, making and use of fertilizers for lands, use of artificial yarns for cloth, making and uses of cement, bricks and so on, the things with which the child is familiar in his environment. They should be mostly in the nature of biographies of scientists. They should bring forth in their lessons the rational way of thinking scientists adopt for the solution of their problems, and the use they have made of natural resources like a waterfall, coal, wood, iron, and other raw materials for economic benefits. Young children should also be encouraged to develop their powers of observation in understanding how nature works and how simple machines work, and develop manual skill in making simple useful gadgets. The importance of basic education to the development of our economy cannot be overstressed. This idea is by no means new. It has been vigorously supported by Mahatma Gandhi, Dr. Zakir Hussain and others. The Ministry of Education has made a beginning, but it has been a very small beginning to make any impression on technical development. It therefore needs to be more vigorously pursued.

Another difficulty which has to be removed is the wide disparity in the scales of pay between the craftsman and the engineer at the top. It does not require any elaborate argument to prove that the entire success in the implementation of any technical project however brilliantly planned depends ultimately on the skill of the craftsmen who execute it. It is as difficult to acquire skill as it is to get a degree or even a doctoral conferment. The best worker is as important to the nation as the best planner. Since the numbers of the best in both these categories are small, the financial reaction of this proposal on industry is small while the gain in the quality of workers they can get is inconsiderable. The acquirement of technical skill will at the same time assume new dimensions of respectability.

Boys fight shy of taking up a technician's career not only because of the low scales of pay and the social status attached to it, but also because they have no chance of improving their lot. Once a technician, he remains so for ever, however brilliant he may be. He can never be an engineer. This has to be removed by developing on a large scale extension courses like holding evening classes and correspondence courses in plant training and so on. The Institution of Engineers (India), I am glad to say, is playing its part, in its own humble way, in offering hope where there was despair, prospects of affluence where there was poverty, social respectability where there was none, to those anxious to play their part in engineering the technical development of our country. Last year 776 students completed their Sections A and B of our Associate Membership Examination. This is by no means a big achievement considering the leeway we have to make to come up to the level of other advanced countries. Accelerated progress can again be achieved with minimum amount of expenditure on buildings and equipment if we throw open our numerous engineering colleges and polytechnics for training students in the evenings for our examinations. Retired engineers and others willing to do work in the evenings can be employed. Dr. Sen in his last year's Presidential Address announced that the Ministry of Education not only welcomed but was even willing to extend financial help to all institutions willing to take up this work of training students preparing for the Associate Membership Examination of our Institution. To you, Sir, let me on behalf of our Institution express our grateful thanks. The Institution in a modest way is helping this extension work by forming book banks in engineering colleges. On this occasion I wish to acknowledge the help rendered by the various donors to the Public Charitable Trust for the Advancement of Engineering Education and by yet others who have made generous gifts of books and equipment to the various Local Centres and Sub-Centres of the Institution.

I have also to acknowledge the munificence of the many State Governments who have made very generous donations both in land and in money for the buildings of the various Local Centres of the Institution. It may not have been possible to proceed so successfully with these constructions, which serve as foci of engineering activity in the respective States, without such ready assistance. Some of the State Governments have also made substantial contributions towards providing books and equipment at the Local Centres.

It would be appropriate if I take this opportunity to say a few words about the new Headquarters building of the Institution in Calcutta. The building in which the Headquarters is now housed was built in 1931 when the membership of the Institution was 1,200. An annexe was added in 1956 when the membership had risen to 15,900. Today, the Institution's membership is 52,000. The Headquarters has been suffering from a several shortage of space and the Institution hard pressed for funds, which have been used primarily for expansion of technical activities. The space problem became so acute in 1962 additional accommodation had to be rented. It was finally decided to construct a new multistoreyed building for the Headquarters as the only solution, and construction was started last year and is now proceeding apace.

There is a serious paucity of funds, however, and I would like to express the hope that both the Central Government and industry will readily come to our assistance and contribute generously to enable early completion of the building.

Another factor which has inhibited progress of technical development, specially in Government departments, is the lack of insistance of those employed under them to keep themselves well informed of the latest developments in their own fields of specialization. I have personally known of many Executive Engineers who did not have a single technical book with them. Still they have risen to positions of Superintending and Chief Engineers and retired. Nobody seems to be worried about their technical efficiency. As pointed out by Dr. Sen in his Address last year, it is high time extension courses in the way of short-term refresher courses or seminars, are organized and opportunity are afforded to such persons to attend them. In addition, suitable incentives should be given to them, specially to the junior staff, to join technical Institutions like ours, to travel to the places of our meetings and take part in the seminars, symposia and other technical activities. I am glad the Defence Ministry has already done so. The Education Ministries at the Centre and the States who of all others should be vitally concerned in seeing that their technical teaching staff keep themselves up-to-date by joining Institutions like ours or by other means have not yet moved in this matter. Many firms in the private sector have been very progressive. May I appeal to the many more to follow suit by giving incentives to their employees to join our technical activities ?

Last but certainly not the least factor which is retarding progress of technical development is the poor quality of training imparted in a large number of institutions. There has been no effort to maintain an all-India standard of quality. It may be recalled Dr. Sen suggested last year the formation of an Accrediting Board at a national level comprising representatives from the interested organizations as the Ministry of Education, the Union Public Service Commission, and our own Institution, which could act for the country as a whole. Unfortunately, there has not been much progress made in this direction.

I have deliberately not gone into the details of the organization and of the courses necessary for the purpose. The policy now proposed is with reference to the present developmental environment, and there will necessarily have to be shift in the policy with the progressive technical development in the country. Policy-making should be dynamic in character. When once the policy suggested is accepted, the details for its implementation can then be worked out.

In fact, we are now having a Seminar on this very subject. I am happy to state that the response to our Seminar has been wonderful. Seminars on the same subject have already been held at the various Local Centres and Sub-Centres throughout the country. The total number of papers received at the various Centres and for the Convention here exceeds a hundred. It can easily make a volume exceeding 1,200 pages of printed matter. It is also representative of all types of persons in the Institution, directors, designers and planners in engineering concerns, professors and others in teaching and research institutions, industrial consultants and students. It is proposed to bring out a volume containing the views of the Institution on the various aspects of technical education, and present it to our distinguished colleague and Immediate Past-President, Dr. Sen, a member on the Central Planning Group set up by the Ministry of Education to draw up a perspective plan of educational development for the next 15 years, 1966-81.

Sir, we are extremely happy and proud that the Ministry of Education has included the Immediate Past-President of the Institution, Dr. Sen, in their Education Commission. Our experience in the past in this direction, I am sorry to say, has not been happy. More than blaming the Government, we should blame ourselves for this sorry state of affairs. We should ask ourselves, why is the Government rushing in for foreign consultants even in simple matters like a water supply project for a city ? Why do they persist in keeping out our Indian consultants from big projects like the steel projects, though they are never tired of exhorting Indian consultants should be encouraged ? Why is our Institution, representing as it does 13,000 graduate engineers and nearly 40,000 students—easily the biggest technical organization in the country—kept out of the councils of the Government in matters of technical development of the country ? Why is it we have no representation in the Cabinet Scientific Advisory Board, and why not even in the Governing Body of the Council of Scientific and Industrial Research, in the Councils of the Defence Research Committees, and a host of other technical committees ? The answer is not far to seek. We have not gained sufficient strength to make ourselves felt. Looking at our own history, we fought against a foreign power and got political *Swaraj*. It was not given but taken. Unfortunately, the slavish mentality of looking up to foreigners for everything technical persists. We must fight this out. Luckily we do not have an enemy to fight our battles. We have only our own brothers on the other side. All that we have to do is to convince by our achievements, our arguments, our behaviour and our strength that we are determined to achieve technical *Swaraj*.

Gentlemen, let me, as your elected captain of the year, call out 'Arise, awake and stop not till our goal is reached.

Jai Hind'.

THE EIGHTH SIR MOKHSAGUNDAM VISVESVARAYA LECTURE*

N. V. Modak
Honorary Life Member

It is a signal honour to be invited to give this lecture and I appreciate it greatly. I have had the privilege of knowing Sir M. Visvesvaraya intimately, whom we remember with gratitude on this occasion. I had heard about him when I was a boy and had the good fortune of being closely associated with him in professional work when I became an engineer. In my professional life, he was my *Guru*, friend and philosopher. He was not only an outstanding irrigation engineer but also a great and distinguished sanitary (public health) engineer. Besides, he was a very eminent and efficient administrator. In the latter part of his life, he was keenly interested in the rapid industrialization of the country as he firmly believed that it was the best way to increase national wealth and to provide employment to large numbers of people which in turn would contribute to raise the standard of living of the people. He served the country with great distinction in a spirit of dedication and devotion.

Need for industrialization

His emphasis on the rapid industrialization of the country was rational. It is recognized all over the world that the prosperity of a nation and the well-being of its people depend largely on the agricultural and industrial production of the nation. It is also recognized that high level of productivity can be achieved only if individual and public health is satisfactorily maintained. This is aptly summed up in the proverb 'Nation's Health is Nation's Wealth'. Sir M. Visvesvaraya took a prominent part in the promotion of public health, by constructing monumental works of water supply, sewerage and sewage treatment.

Efforts made by the State and Central Governments towards industrialization both in public and private sectors

We are lagging far behind the advanced industrialized countries, though vigorous efforts are being made by the Central and State Governments since Independence, to make us self-sufficient in food and other necessary things required for healthy and comfortable living by establishing certain basic industries in the public sector and by encouraging development of other primary as well as ancillary industries in the private sector.

Growth of industrial development in the country

Industrialization which involves manufacturing activity in factories of modern type is however a comparatively new phenomenon in India. It was in about 1860 that large-scale industries began to be set up chiefly with British capital. The pace of industrialization was however slow. It received a great momentum during and after the Second World War. The construction of railways was first started in 1853, when the railway line about 20 miles in length was built between Bombay City and Thana. The development of road transport on a national scale started only after 1930. The transport system has since grown considerably but is still in need of further expansion for affording facilities for transport of raw and finished materials to industries as well as for linking towns and villages in the country.

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*Text of the Eighth Sir M. Visvesvaraya Lecture delivered at the 45th Annual Convention, Lucknow, February 21, 1965.

The Planning Commission has done well in undertaking a comprehensive survey of transport requirements and traffic problems of the country. One of the main features of the present survey is that it is being conducted state by state. This will also facilitate an assessment of transport needs on a regional basis. The previous survey has revealed that road transport has made considerable headway on long distance routes, accounting for about 8,000 miles out of the total 15,000 miles of national highways and another 2,000 miles of State highways.

Export and inland trade was started much earlier by the British for exporting indigenous raw materials to Great Britain and for importing large quantities of British-made finished products into the country. This position would have continued even after the Second World War if there had been no change in the administrative set-up of the country.

Sir M. Visvesvaraya's Ten-Year Plan for the 'Planned Economy of India'

It was in 1934 that Sir M. Visvesvaraya published a Ten-Year Plan for the 'Planned Economy of India'. The objectives of his Plan were fivefold : (1) to concentrate attention on increasing production by using modern tools and machinery, (2) to obtain for this activity all the guidance that could be had from foreign experience, (3) to mobilize the country's resources in men and money, (4) to regenerate the national will for accomplishing national well-being not only for India but also for the world at large, and (5) to make India economically strong, *i.e.*, industrially efficient, educationally strong and thoroughly modernized in collective cooperative effort.

The outline of his Plan was such as to retain the best features of individualism to which India had been so deeply attached and to build up at the same time the system of collective effort without which economic progress was not possible. He emphasized that in order to achieve the above objectives, the ideals of sacrifice, surrender, and service should be accepted in the place of mere individual gain, personal profit and single pursuit. He was confident that if his Plan was vigorously implemented, the three fundamental needs of the country, namely, education, industries and military training, would be adequately met and remarkable progress would be made towards economic growth and nation building. The implementation of the Plan according to him would have also brought under control unemployment, poverty and suffering and thus made India 'a progressive, better, lovelier and happier place to live in'.

Effect of industrialization on towns and villages

Since Independence, the pace of industrialization has grown faster. It has, however, brought in its wake certain problems. It has promoted the growth of urban centres and made certain fundamental, economic, social and political changes. The growth of non-agricultural industries, as a major source of earning, has brought about an important economic change. This has been accompanied by changing occupational patterns, changing employment status and changes in the location of production. The modern organized industry has also made significant impact on the social life of the community.

All this has resulted in increasing the proportion of population living in urban areas from 11% in 1901 to 18% in 1961. The proportion of population living in large towns having populations of 100,000 or more has increased faster from 2.5 to 8%. Since 1941, the population movement from rural to urban areas has been more conspicuous. During the last decades (1941-61) it is estimated that nearly 14 million people have migrated to urban areas.

This exodus from rural to urban areas has affected the traditional agrarian economy of the country. It has acted adversely on the village handicrafts and village industries resulting in large-scale unemployment in villages which has led to the migration of villagers to urban areas in search of employment. This exodus of villagers to towns has resulted in changing the 'on-account workers' into 'employees' and the relationship between the worker and the final product has become more indirect. Due to this, villagers have become more and more dependent on urban centres. The interaction between villagers and town people has also exposed the village community to the influence of the urban type of living.

In 1961, 87% of urban workers were engaged in non-agricultural industries. The corresponding percentage for rural areas was 18%. While most of the workers in urban areas are 'employees', a large number of them in rural areas are owners of land, farmers and 'on-account workers'. About 30% of the urban work-force is enagaged in services of low productivity. Some of the urban workers are living in conditions of rural poverty in urban areas without any impact on the urban way of life.

It is the technically superior large-scale manufacturing, that brings not only higher level of productivity but also a higher degree of urbanism in the life of the community. Unfortunately employment in such organized industries is still small even in urban areas.

The city-ward migration is typically unorganized and haphazard. The worker is unskilled and remains unskilled. There is a continual drifting back and forth between the country-side and the city of unskilled unstable labour force, which brings no lasting benefit to industry, to agriculture or to the worker himself. A villager does not acquire fully the urban mode of life as he is unwilling to sever his connections with his village and land. This is the root cause of absenteeism of the industrial worker who continues to remain a part-time peasant.

Experience elsewhere has shown that modern industry can bring about a high standard of living and extensive economic and social changes, but in India, it still continues to be a minor source of employment. Without major economic changes in terms of industrialization and employment structure, striking social changes cannot take place quickly. So long as the standard of living remains at the subsistence or below subsistence level, only minor social changes can be expected.

The national income during the past ten years (1951-61) increased by 40% but a major part of it was absorbed by the rapid growth in population, so that the *per capita* income increased hardly by 16%.

Effect of abnormal increase in the growth of population in the country

At a time when most experts fear that India is fast heading towards the demographic point of no return, which would nullify all her efforts at raising the standard of living, a British economist, Prof. Colin Clarke, has enunciated an exactly opposite viewpoint. In a paper submitted at the population control symposium held in December 1964 under the auspices of the Eucharistic Congress in Bombay, Prof. Clarke said that far from getting perturbed over the population explosion in this country, we should be happy over our baby boom. According to the Professor, the anxiety expressed over inadequate supply of capital in developing countries with fast growing populations is unfounded. He feels that a growing population in itself provides opportunities for enterprise and with that, the capital supply will look after itself. The British economist's arguments may be right in general context but one cannot help questioning their relevance to conditions in over-populated countries. It is true that population growth provides incentives for enterprise and capital creation in under-populated countries where there is plenty of scope for expansion but in countries where the saturation point has already been reached, further growth in population would only hinder progress. With limited opportunities, the dynamism of the people would be stifled and the economy is likely to be retarded.

Prof. Clarke also challenges the proposition that our agriculture is afflicted with surplus labour. He contends that as the country's agricultural operations are controlled in particular seasons, over a restricted period, all the available labour is needed during that time to produce sufficient food. He holds out a warning against employment of 'surplus' farm labour to other fields of activity because by doing so he thinks that we would be facing the fate of China, which by shifting her agricultural labour to industries invited a major food crisis. It must be pointed out in this connection that labour is not the only factor contributing to adequate food production. Other important factors are better methods of farming and irrigation which ultimately cut down human labour. It will obviously be wasteful to keep a big labour force idle for a major part of the year.

On the other hand, the two renowned American economists—A. J. Coale and E. M. Hoover—have pointed out in their Princeton Study Report, that if the population growth in developing countries including India is not checked effectively and immediately, no development would keep pace with the population.

Eugene Black, President of the World Bank, told the United Nations, 'Population growth on this scale (2% or more) would be a serious challenge to a country with adequate living standards. Where the incomes are low and economic developments are a desperate need, such growth can be a crippling handicap. Population growth threatens to nullify all our efforts to raise living standards in many of the poorer countries. Unless it can be restrained, we may have to abandon for this generation our hopes of economic progress in the crowded lands of Asia and the Middle East. It is high time the respective governments gave earnest attention to this threat to their aspirations'. So far as India is concerned, its increase in population is 2.1% per annum.

Memorandum of the Planning Commission issued in December 1964

This view has been confirmed in the memorandum released on December 2, 1964, by the Planning Commission in respect of the Fourth Five-Year Plan. According to the memorandum, the national income was expected to increase by 30% during the

Third Five-Year Plan but it has increased by only 10% during the first three years of this Plan. Even with better performance during the remaining period of the Plan it is not likely to rise beyond Rs. 17,400 crores against the target of Rs. 19,000 crores for the current Plan. This target of national income of Rs. 19,000 crores was set in 1961 when a fifteen-year long-term Plan was formulated.

The anticipated rise in the population during the current Plan of 492 million is likely to increase to 495 million at the end of the current Plan period.

The basic objectives of this 15-year long-term Plan were to lay sound foundations of self-sustaining economic growth to provide avenues and opportunities of employment to all those who seek it and to narrow the economic and social disparities, to ensure a minimum level of living to every family in the country. It was anticipated that the *per capita* income would increase from about Rs. 350 at the end of 1960-61 to about Rs. 385 at the end of the Third Five-Year Plan, to Rs. 450 at the end of the Fourth Five-Year Plan and to Rs. 530 at the end of the Fifth Five-Year Plan.

It is indicated in the memorandum that the 15-year perspective will be revised in the light of the experience so far gained but there would be no resiling from commitments regarding employment and living standards.

It is further stated that if a high rate of growth is not achieved during the Fourth Five-Year Plan, it would have serious consequences on the country's progress. The shortfalls in the Third Five-Year Plan make it necessary for the economy to strive for much higher rate of growth than originally envisaged for the next two Plans.

Why anticipated targets have not been achieved ?

I now propose to discuss some of the reasons why the anticipated targets of the Plans are not being achieved.

For the growth of successful industrialization, stress must be laid on programming, organization, management and training of labour and technical staff employed from its inception to completion, putting into commission, and economical and efficient operation and maintenance thereafter. Programming is found to be deficient in terms of detailed forward planning of technical, material and man-power requirements, economic results, phasing, time and production schedules, etc. It also appears that the modern techniques used in foreign countries for successful operation of industries have not been fully made use of. The Government of India have created a central management pool to provide managerial personnel for public enterprises but the scheme has not made much progress so far. The development of such personnel from within the undertakings and enlarging their competence and of attracting outside talent of superior calibre does not appear to have been given the attention it deserves.

There is an intimate connection between the quality of preparation that goes into the first phase and the efficiency of management planning and control 'downstream' in the construction and production phase. There is therefore more need for effective management techniques in the initial period. In some projects, the cost of inadequate planning in the pre-construction phase has been very heavy.

The first step in the construction planning is the preparation of a work breakdown structure. Once the programme objectives are identified and translated into the work break-down structure, a plan of work for achieving each objective or item of work in the most desirable manner has to be developed. The 'network' technique Programme Evaluation and the Review Technique (PERT) or Critical Path Analysis (CPA) should be then adopted to put the work activities in some sequence as all activities pertaining to the work cannot be simultaneously started due to technical constraints and resource limitations. These techniques are being used in the U.S.A. Both of these techniques describe the work of the entire projects in the form of a network, showing the inter-dependence between the various activities. Although, PERT and CPA started as two different techniques, they have now grown very similar and are known as 'Network Planning'.

Two seminars on this subject were held, one in Delhi and the other in Bombay in October 1964. The seminars focussed the attention on the most striking handicap in the field of management in India, the absence of information system designed to facilitate decision making. It was pointed out at the seminars that the top people should be able to visualize the future conditions and needs and to plan growth accordingly. The growth will create more opportunities and chances for those people at lower levels of creative application and instil into them a sense of freedom, dignity and responsibility. Training courses for engineers and upper level technicians in the application of PERT and CPA are therefore essential. Steps in this direction are urgently needed.

Inspection of end-products is also of vital importance to the industry. It has to be integrated with production processes at various stages of manufacture to avoid a major rejection of the end-products. It is becoming more and more evident that quality control cannot be regarded as a separate function, completely independent of the design. Manufacturing and sales activities, sampling techniques, control charts and inspection methods are only a part of the total quality concept. Economic analysis of procedures, relation between product quality and process control and evaluation of maintenance and after-sales service are vital for total quality control. All these factors have to be balanced against cost and they are not only important to the consumer and the manufacturer but also for national productivity.

Some reasons for shortfalls in public and private sectors

Investment in the public sector industries is reported to be about Rs. 1,400 crores while the profit is said to be of the order of Rs. 12 crores, *i.e.*, less than 1%. Really speaking, the profit should have been at least 10 %. This shortfall, according to some, is attributable to the following factors :

Public sector.:

(i) Lack of far-sighted administration at the top,

(ii) Constant transfers of the chief executives,

(iii) Lack of development of team-spirit,

(iv) Lack of fixing responsibilities at different levels which impairs efficiency,

(v) Lack of productive incentives,

(vi) Provincialism and nepotism,

(vii) Lack of appreciation of good work by giving proper rewards on the one hand and extreme difficulty and complications to remove, demote or otherwise penalize employees in cases in which such steps are undisputably justified,

(viii) Unawareness of the importance of preventive maintenance,

(ix) Lack of qualified personnel of adequate ability at various levels both on administration and productivity sides,

(x) Lack of standardization of indigenous raw materials and their shortages in places where industries are located to enable the top executives to plan in advance for particular production,

(xi) Unimaginative and constantly varying import policies and administrative delays in obtaining licences for materials required to be imported,

(xii) Structure of the existing labour legislation which is not conducive to industrial efficiency,

(xiii) Scales of salaries offered being low, the private sector is able to secure the best talent in the country, leaving the public sector to make good with the available personnel of lower talent,

(xiv) Railway facilities are over-strained and are unequal to fulfil the task imposed on them, and

(xv) Lack of sufficient electric power and frequent breakdowns

Private sector:

(i) Government control at various levels. Bulky and complicated provisions of the Company Law and its administration,

(ii) Tapping of available financial resources for public sector industries and Welfare State projects leaving a small residue for investment,

(iii) Differentiation in making available public facilities between the public and the private sector industries, and

(iv) Labour legislation as in the case of the public sector.

The objective of planning

Planning is not only an aid to cost control but a *sine que non* for an industry which is interested in reducing the cost of production and in serving the nation by bringing down prices of consumer goods.

All planning activities have two elements—one is a comprehensive stock-taking of the real and financial resources of the economy, and the other, an attempt to project into the future the use of these resources in such a way as to achieve the maximum development. The two key questions are—'where are we now' and 'where shall we go from here.' The second question is a challenge to the imagination of the expert and the policy maker. If enough importance is not attached to the first part, planning becomes a mechanistic exercise of spelling out with various degrees of detail and accuracy under various assumptions which may or may not be justified. Further the more the planning period extends into the unknown and the more ambitious the planners are about methods and refinements, the greater is the gap between the presumed basis of the plan and its real basis in work-a-day economy. Many development plans in different countries have become obsolete, before they were completed, because they were not up-to-date to begin with. The only way to avoid such a situation is to improve the flow of current information from the various sectors of the economy and particularly from government departments to the planners. It is only on the basis of a thorough knowledge of what is goving on in the present that any meaningful determination of what is to happen can be made. Moreover, the stimulation of the constant flow of data is bound to help the planners to make a rational choice among alternatives and to determine attainable targets. Even more useul is the appraisal of the response of the various sectors of the economy to measures already taken.

In this context, the views recently expressed by Mr. Goodman of Great Britain, industrial specialist of the 'Electrical Department', will be found interesting. He said 'conditions we create in the next few years will determine the position of this country (Great Britain) in the 21st century. It was essential to plan for the future in such a way that radical innovation could be made without big social or technical disturbances, without large wastage of capital, and not the least, without human wastage. It was useless planning for the future on the basis of today's equipment. Initiative, enterprise, imagination and technical ability are essential.' He further stated 'the right type of leadership is essential in order that the right type of technical change comes about. Automation will bring about radical changes. It is imperative that our industrial leaders understood what automation is all about. The challenge for change must be the watchword for our young men and they must be encouraged to innovate and to change wherever it is practical and economical.'

Mr. Goodman forecast that machines in the future would be made of some type of organic material which would completely reorganise production as it is now understood. It will not be possible to readily identify the units as machines at all. There would be a great expansion in the use of electricity in factories. Automation would be a better way of putting more and more energy—electrical energy—at the workers' disposal. He added, by A.D. 2000 we would not see the large industrial conurbations we have today. Small highly productive factories will be scattered about the countryside producing goods, throughout the 24 hours, seven days a week, just as electric power stations generate electricity today. Automatic cars and lorries, dialled for their destination, would go running unattended on motor roads.'

Regarding aspects of design, Mr. Goodman said 'products must be designed for the function they would perform and they must also be designed to suit production methods. This would be the key to the introduction of automation. The handling of components by mechanical hands requires a different shape of article to that suitable for easy handling by human hands'. In conclusion Mr. Goodman pointed out that automation would make many skills superfluous. With the increasing pace of technical advance the problem of redudancy would always be with us. He asked 'what can we do about the traditionally trained man whose skill is no longer required, and how can be train our young people so that they can swim on the tide of technical advance? Both aspects require intensive study now. In future, hybrid skills would be required—electro-mechanical technicians, system technicians and men who can maintain complex mechanical, electrical and electronic plants'.

Increase in the output of trained personnel

It is reported that since 1961, the industrialization index has gone up three-fold, but the production has not come to that level, for want of trained personnel. In the U.S.A., the ratio of the output of technologists is about 120 per one million population while in the U.S.S.R. it is three times this figure. Unless the output of trained personnel is increased in the country, the productivity may not increase as required.

Role of trade unions

Trade unions in the country must be made to play an important role in increasing productivity. Today, they do not appear to make any contribution towards increasing the productivity as is the case in highly industrialized countries. The work of training workers in advanced countries is organized by trade unions. The worker is made to realize his position in the economy of the country, despite his illiteracy and what the country expects of him.

The Russians have started a tremendous educational aid organizational campaign, designed to promote the initiative and creative urges amongst the working people, especially to enhance their role in economic development. The most significant factor today in the Soviet Union is that trade unions are playing an increasingly important role as a 'school of management, a school of administration and perhaps also as a school of teaching political doctrines'. Previously, their role was limited to collective bargaining and the running of welfare services for their members. In recent years, however, scientific and technical societies have developed through the help of trade unions for improving management in the whole gamut of industrial development. Public design and technological officers, economic analysis teams, research institutes and laboratories, rate selling bureaux, technical information offices and other creative public bodies have begun to function on a voluntary basis through the help of trade unions. They are becoming an important economic force. Their activites help to raise labour productivity and accelerate scientific and technical progress. In a way, they are a school of management, a new example of participation of workers in managing production.

This development is organically connected with the new stage of sophistication, the Soviet industry has reached today. It is found that without extension of industrial democracy and release of creative energy of the working people, the Russians cannot improve labour productivity and reduce costs of production. It seems that it is primarily more for economic reasons rather than for any moral or political purpose that the institution of industrial democracy has come about in the Soviet Union.

Technical education and industrial training at present imparted not conducive for the achievement of Plan targets

One important reason for non-achievement of the targets of the Five-Year Plans according to some, is the unsuitability of technical education and industrial training that is being imparted today in our technical schools and colleges. The teaching methods followed are not such as would stimulate and direct individual student's intellectual effort. Very little research into methods of teaching technical subjects appears to have been made in the country. In Britain, effective work has been done by enthusiasts, over the years, and there is a growing support for studies directed to improve the quality of technical teaching. The teaching method problem is to apply the fundamental educational ideas to the wide range of technical students' abilities and needs.

The Ministry of Education (Great Britain) have made many recommendations regarding integration of school, further education and industry. They include a greater emphasis on the theory and practice of technical education and training of student teachers in the University Department of education and training colleges, period of industrial experience for all student teachers fairly long exchanges between the staff of schools and technical colleges, more frequent seminars, study groups, courses, conferences and meetings between school and technical college teachers and their colleagues in industry. Though education is intended for living, the tendency in the practice of traditional education has been to ignore that living includes the earning of livelihood and that education must provide learning for earning a livelihood.

Industrialists in the U.S.A. are also feeling that the gap has been widening in recent years between the educational needs of the American industry and the educational offerings of the American higher education. Due to the interest in the sophisticated fields like nuclear energy and space exploitation, the curricula of most engineering colleges have gradually shifted a little away from preparing students for employment in the bread and butter segments of industry such as engineering design, manufacturing processes and production supervision. One of the reasons for this widening gap is the trend towards promotion of scientifically oriented scholars into positions of administrative leadership in engineering colleges and universities. Such leadership is bound to perpetuate, if not to lay, the emphasis upon the theory rather than upon the practice and the 'science' to the exclusion of the art of engineering and technology.

In this connection it may be mentioned that a programme for giving experience of technological decision-making in industry to young engineering professors has been recently announced by the Ford Foundation.

Training for preparing semi-skilled and skilled workers

We must provide increased facilities for more employment by giving some sort of training to the millions of unemployed so that the best and most efficient and effective use could be made of them. They must be prepared for efficient performance of the work on which they would be employed. Most of them will have to be trained as semi-skilled or skilled workers. For this purpose, they must be technically trained. This training must be preceded by elementary general education. Literacy should be the condition precedent for all technical training. It is therefore essential that the present rate of rise in literacy of 1% per year must be raised to 5% per year if literacy is to rise from the present 20% to at least 75% in the next ten to twelve years. The education for the young and the adults must include instruction in the three R's and study of trees, plants, birds and the land, they see around them. A little training in the use of hands through gardening and carpenters' tools will provide the beginning of the technical training. The adults who already know manual work will not need this part of instruction. To achieve this objective, the budgets for primary and adult education of the States and the Centre will have to be appropriately increased. It is absolutely necessary to provide facilities for technical training for those who leave primary school at the age of 11 and 12 or middle school at the age of 13 or 14 because they are not in a position to pursue higher general education on account of financial or other reasons.

Apprenticeship system

In England, the apprenticeship system has been made cumpulsory. The Industrial Training Act of 1964 gives the Minister for Labour power to set up boards for industry and commerce whose duty is to ensure that training is provided by firms and to supervise its quality. Employers who do not provide such training will have to pay a levy but they may be compensated by those who provide training facilities for their workers by a grant towards a part or whole of the cost. No legal obligation has however been placed on the employers to engage apprentices or to release them for instruction in day colleges. The British industry has always realized its responsibility in this matter.

In other European countries like West Germany, France, Italy and Netherlands, the apprenticeship system is more extensively used. In West Germany, training of apprentices is considered to be the primary responsibility of the industry itself. There, an applicant for apprenticeship is put through intelligence and aptitude test, and, if acceptable, enters into a contract with the employer firm. The training given is general and varied and not of a specialised character. This enables the trainee after completion of his training, to work in any branch of the industry. During the training period, the apprentice keeps a work book in which he describes in detail what he has learnt, week by week, and this helps to determine the quality of his performance. The period of apprenticeship training is three years and not five years as in England. The theoretical training is given in technical schools. An indentured apprentice in Germany who fails at the National Organization Examination can sue his employer if his training is inadequate.

Kind of technological and scientific training necessary

There is no denying the fact that the rapid application of modern techniques in industry depends upon men trained in those applications and this, in turn, gives rise to the need for a copious supply of high level training and research necessary for any appropriate target.

Technological and scientific training must be based on multi-faculty technological universities, which will attack the problem of modern industry on the basis of groups such as (i) Engineering Sciences and Technology, and (ii) Industrial Engineering and Management studies and Sociological Sciences. These technological universities should be fed by groups of feeder colleges corresponding to the regional and district technical colleges on the lines of Great Britain.

In the United States and Russia nearly 25% of university graduates take degrees in Industrial Engineering and Applied Management and Production Technology and engineering is contained in the curricula of studies. This development is proceeding at a high rate in those countries because of the increasing development of numerical methods in the connection between the drawing board, manufacturing techniques and quality and cost control. It is recognized in that country that the development of Industrial Engineering and Applied Management has created the need for an equation between high level industrial engineering calling for a number of skills rather than single skills on the part of individual craftsmen and that fluidity on a multi-skill basis is necessary from the craft side.

The apprenticeship system exists in our country but the training given to the apprentices cannot be said to be satisfactory. It is reported to be causual, indifferent and unsatisfactory. We have still much to do in the training of artisans and craftsmen especially for medium and smallscale industries.

Recommendations of the Estimate Committee of the Third Lok Sabha

The Estimates Committee of the Third Lok Sabha in their report on personnel policies of public undertakings published on April 6, 1964, has touched the problem of training for industry. Its recommendation *inter alia* is as follows :

> 'From the point of view of the long-term economic development of the country, it is necessary to plan for training the required manpower to meet the increasing demands of public undertakings. A fully coordinated and integrated training programme for the undertakings functioning broadly in the same field of technology is called for. A study should be made of the utilization of training facilities available in different public undertakings, which have been organized at considerable cost, and steps taken to utilize the surplus capacity if any.'
>
> 'The Government should consider the desirability of setting up an advisory committee under the Directorate of Employment and Training to ensure that new training institutions are not set up by public undertakings if their needs could be met by the existing ones. The Government should impress upon public undertakings the need for introducing a regular induction course for their employees.'
>
> 'Regular programmes for training supervisory and middle level personnel should be organized to meet the increase in the workload and responsibilities as a result of the expansion of the public sector. Training within industry schemes may be introduced in all public undertakings on a wider scale.'

Need for research

In addition to the measures necessary for manning our industries with qualified and skilled and semi-skilled personnel, science and engineering must work in continuous partnership for placing India on a higher plane by continuous research. In foreign countries, enormous mechanical engineering developments in the launching of huge vehicles into space and their subsequent orientation and control in designed orbit has taken place. There have been revolutionary developments in electronic circuit design with miniaturized components. Radio communication is being used for conveyance of instructions to a space craft as well as for transmission of information it gathers to receiving stations on the ground.

Advanced industrialized nations are financing research to modernize their equipment and administration and to train technologists and technicians to increase productivity. They are insisting on the apprentices attending technical college courses to obtain the appropriate qualifications. They have provided efficiently staffed and well-equipped training workshops and schools. If factory training is not possible outside the production shops, their apprentices attend apprenticeship courses in the local technical schools or colleges.

For increasing productivity to maintain an overall balance in the national economy, Mr. F. G. Donner, Chairman of General Motors, in his message to the teachers of engineering and allied sciences said, 'It is the engineer, by list, the design engineer, the process engineer, the production engineer and the research engineer whose innovations are chiefly responsible for increasing productivity. The engineer has been in the forefront of those who have worked to accelerate economic growth. He has been primarily responsible for finding ways to make new and useful products and to make them more efficiently. Only in this way, has it been possible to build more and better products, which in turn has meant increased employment opportunities, higher real wages, and higher standard of living. It is the equipment coupled with better product design and improved manufacturing methods, often the end-products of years of engineering development, that translates advancing technology into lower costs and better quality.'

Qualities necessary for leadership

It is needless to observe that the engineer in India must play a leading role for the achievement of the targets of our Five-Year Plans. To enable him to do so he must possess certain qualities. They are : firstly, courage, it is the basis of all virtues both in man and beast. The higher you get in any structure the more of that courage must be moral courage. Secondly, will-power, because whenever you want to do anything new, it is astonishing how much opposition you will meet. Thirdly, flexibility of mind, because we live in a changeable world and without flexibility of mind, courage and will-power can be dangerous. Fourthly, knowledge, not of how to do the other fellow's job but enough to know about how long it should take him and how best you can help him. Fifthly, integrity, upon which all other qualities depend. It is because of your integrity that people trust you. These five qualities are basic for a leader in any situation.

Industrial townships and decentralization of industry

The world has undergone and is still undergoing great changes in economic structure and output. Amidst these world conditions, the disquieting change that is taking place in our country, as pointed earlier, is the rapid growth of population without a corresponding rise in production or income. Similarly, with the increase in industrialization the problem of 'Ekistics' which means the settlement of population is being neglected. Though a few industrial towns for heavy and basic industries have been established in the public sector, the pressure exerted by the expansion of existing and new industries in the private sector is being actually felt by our major towns and cities. The lure of lucrative industrial employment is acting like a magnet on the village population to the detriment of corresponding increase in agricultural production which is so essential for the country's balanced economic development. At the same time, industries have created undue pressure on the public utilities provided by the towns and cities which are falling short of requirements. This imbalance has resulted in creating housing shortage, new slums and increasing juvenile delinquency and lowering of morale standards.

To avoid such evils and to attain a better standard of living, befitting a 'Welfare State', the settlement of new population in urban areas must be organized on a rational basis. To do so, decentralization of industry consistent with its basic needs is imperative. This will ensure even distribution of industrial population all over the country and check the exodus of village population to towns. This will necessitate the preparation of regional and national plans as a part of the Five-Year Plan. The regional planning should lead further to Master Plans for towns, villages, sectors, neighbourhoods and housing. This appears to be one of the ways for ensuring balanced distribution of our growing population and reducing unemployment which is rampant at the present moment.

Role of the Public Health Engineer

This urbanization created by industries has posed several problems in respect of public health. Though the products of rapid industrial development and improved technology are beneficial to mankind, some of the by products are not so beneficial.

The Public Health Engineers comes in the picture here. First, he has to discover the nature of the threat; second, to determine the extent of damage, actual or potential; and third, to develop means for its effective and economical removal or suppression. For this, he has to look to research, to control the environment we are creating.

Historically, public health engineering has developed as a field of specialization for the civil engineer. The work of the public health engineer affects public health in such diverse ways that it is clearly impossible within the compass of a lecture, such as this, to deal exhaustively with the subject and all that can be done is to select the more obvious services which have a direct bearing on health.

Public health engineering may be defined as application of engineering principles to man's environment to water, air, food, shelter and working areas for the protection and promotion of public health.

To enable the public health engineer to tackle the problems, in the above fields, he must have some knowledge of bacteriology, virology, parasitology, entomology, hydrobiology, physiology, epidemiology and ecology. He must also have some acquaintance with bio-chemistry.

Growth of public health engineering

Public health or sanitary engineering, as a science, had its origin in the U.S.A. in the last decade of the nineteenth century. It started with the water phase of the environment, *i.e.*, water supply and treatment, sewage collection and treatment, and disposal. Its sphere was gradually expanded to include the control of insects and rodents of public health importance.

Really speaking, public health engineering has existed ever since men began to congregate in communities. It was however neglected during the period when men were more concerned with the well-being of the spirit and the soul than with cleanliness and hygiene.

In England, the General Board of Health was formed in 1848 to tackle the insanitary conditions prevailing in that country at that time which were appalling due to the flocking of labour from villages to towns, which provided employment, resulting in the worsening of the living conditions of the population as a whole.

Studies of environmental problems in our country have been made by various teams and commissions for more than a century. Most of them were occasioned by some public health crisis.

Sanitary Commissioners were appointed in the provinces of Bengal, Bombay and Madras about the year 1864, with primary responsibilities in the field of sanitation. Along with the Sanitary Commissioners, posts of Sanitary Engineers were created in the three provinces, referred to above, to help the Sanitary Commissioners in providing safe drinking water supplies and adequate arrangements for hygienic disposal of excreta for major towns in the provinces. Health Boards were established in the remaining provinces by 1893 and the Government of India started giving grants for water and sewerage facilities as early as 1896. The Government of India Act of 1935 conferred more responsibilities and freedom to act in public health matters on the Provincial Governments. Since then the State Governments have been doing a great deal of work in the field of envronmental sanitation.

Realising that the economic progress of the country cannot be achieved without good sanitation, the Government of India appointed a Health Survey and Development Committee—known as the Bhor Committee which made a comprehensive report in 1946. This Committee was followed by the Environmental Hygiene Committee which submitted its report in 1949 recommending the implementation of the Bhor Committee's programme regarding improvement of sanitary conditions in towns and villages.

A few years ago, most of the public health activities in our country were connected with the curative side and very little was being done on the prevention side by promoting the improvement of environment. This fact was admitted by the Health Survey and Development Committee which observed 'The creation and maintenance of an environment conducive to healthful living may be considered to be of even greater importance because in the absence of such provision, the services rendered by the doctor, nurse and other members of the health organization will largely fail to produce the desired results. In the campaign of improved health, drugs, vaccines, and sera can in no way replace such essentials as hygienic home, good food, fresh air and safe water supply.'

Magnitude of water supply and sanitation schemes

The National Water Supply and Sanitation Programme was sanctioned in August 1954 and was in operation for only 18 months during the First Five Year Plan period. This programme envisaged granting of long-term interest-bearing loans, returnable in 30 equal annual instalments for undertaking water supply and sanitation schemes in urban areas. Rural projects approved under the programme receive 50% loans from the Central Government.

The magnitude of the National Water Supply and Sanitation Programme can be gauged from the following :

The urban population of the country in 1961 was about 78 million. It is estimated to increase to 120 million in 1981.

It is believed that the existing water supply systems are serving about 30 million people and only 13 million enjoy sewerage facilities. Most of the systems may be said to be inadequate due to continued expansion of towns and industrial activities. From the information available, it appears that about 45% of towns, having public water supply facilities, are supplying water at the rate of less than 10 gallons per head per day and about 6% are supplying at the rate of 30 gallons or slightly more per head per day. In most towns in 1961, the supply *per capita* per day ranged between one and 15 gallons per head per day. In most of the towns the supply is intermittent.

The Report of Water Supply and Sanitation Committee (1960-61) contains the following information which does not include figures for Maharashtra :

Number of towns listed ..	2,447
Number of towns with adequate water supply system ..	371
Number of towns with partial water supply system ..	203
Number of towns with no water supply system ..	1,873
Number of towns with adequate sewerage facilities ..	48
Number of towns with partial sewerage system ..	34
Number of towns with no sewerage system or with open drains only	2,365

As regards rural areas, the rural population in 1961 was about 360 million living in about 5,50,000 villages. Of these, more than 3,30,000 villages do not have adequately protected water supply and 1,10,000 to 1,40,000 villages have no water supply at all. The hygienic disposal of excreta in villages lags behind the provision of water.

It is estimated that for providing all towns and villages with adequate water supply and adequate arrangements for collection and disposal of excreta more than 1,000 crores of rupees will be required.

The Report of the National Water Supply and Sanitation Committee (1960-61) has made some recommendations for expediting the programme of providing water supply and sanitation schemes for urban and rural areas :

Considering the totality of the problems ahead, the Third Five Year Plan allocations form but one-tenth of the total requirements for urban schemes. It is desirable to complete the entire urban phase of the programme within a period of 10 to 15 years, but from practical considerations the period may have to be spread over 25 years. Even such extended period may involve a capital outlay on urban schemes of the order of Rs. 40 crores per year. Such a programme is not possible under the current methods of financing such schemes, where subsidies create an inhibiting tendency. The concept of water as a merchandize has to be popularized and local bodies encouraged to prosecute water and sewerage systems as a joint utility venture on a self-paying basis. Special help may, however, be necessary in the initial stages of the programme to encourage sewerage schemes being taken up side by side with water supply schemes.

Independent statutory bodies styled as 'Water and Drainage Boards' on a regional basis, may be set up clothed with adequate statutory powers to promote and finance water supply and sewerage schemes for all urban local bodies. The statutory bodies will exercise control on investigation, design, construction and operation of the projects on behalf of the local bodies in the same manner, in which commercial enterprise is managed by business houses. Independent statutory bodies for the purpose are necessary to infuse confidence in the subscribing public that their investments on the urban schemes would be properly safeguarded.

The Local Self-Government Ministry should have an effective voice in the implementation of all urban schemes and should have control over the Public Health Engineering Department. The officers manning the department will then have their roots in the local bodies and their policies and actions will be in tune with the aspirations and needs of the local bodies and will be better able to do promotional work in the local bodies to sponsor and pilot their schemes to better advantage. In any case, there is need for greater liaison between the Health and Local Self-Government Ministries in the implementation of the schemes.

The Public Health Engineering Department of the states should gradually encompass within its activities all legitimate functions pertaining to environmental hygiene.

The report lays stress on the procurement of materials required for the implementation of the schemes. If the programme is to be speeded up, the critical materials required for the programme should be made available as they are today much in short supply. It is suggested that the States should participate in the manufcture of the critical materials like C.I. pipes and specials to control the quality and price of such materials.

A judicious choice of materials should be made by the engineers to correspond with actual needs and scarce materials should be conserved for meeting appropriate requirements.

The report includes a suggestion to set up a high power committee to go into this major question to work out details of future requirements and indicate the extent and scope of the industrial expansion needed in this field.

Water supply

In the early days of the nineteenth century water supply consisted entirely of delivery of raw water in the condition in which it was obtained at the source and there was no system of purification. The first attempts at improvement in the quality of raw water were a few subsidiary reservoirs in which some settlement of river water was affected.

It was in 1829 when James Simpson, Engineer to the Chelsea and Lambeth Water Company, built the first sand filter. It operated on a head of approximately 4 ft. and could not be backwashed. This filter was intended to act as a strainer. It was found however that the slow sand filter produced much greater purification than mere straining. The film produced on its surface removed a large portion of bacteria present in the raw water. Slow sand filters are incapable of treating water containing large quantities of organic matter and water of high turbidity.

The exact action of the slow sand filter in removing turbidity from the settled water is still not known. Some of the factors responsible for cleaning action are sedimentation in the filter bed, adsorption due to opposite electric charge, adhesion due to Brownian movement and conversion of stream lines between sand grains, coagulation within the filter bed, biological agencies and colloidal mesh structure on filtering media.

Subsequently, other and more efficient methods of purifying water were developed and they are the pressure and rapid gravity filters. Rapid sand filters could be cleaned by backwashing operations which are generally limited to approximately 6 to 10 ft. head loss before backwashing, due to reduction of flow. Pressure rapid sand filters are generally used for small installations or for water required for industrial use. Their advantage over the gravity rapid sand filter is that they can be normally backwashed as they operate under pressure. Backwashing is usually done when the head loss is approximately 23 ft. The rapid sand filter can be operated at the rate of filtration ranging between 80 and 300 gallons per sq. ft. per hr.

The raw water before its admission to the filters is required to be subjected to chemical dosing, flocculation and settlement. The exact performance of this type of filter is also not yet known. A porous layer is deposited on the top of the sand bed, but this layer is believed to be composed of mostly heavy flocculated material collected on the surface of the sand bed, either by settling, straining or adhering action or by the combined effect of all these factors. The filtration phenomena is so complex that none of the above factors can be said to be responsible for the filtering action.

The object behind treating water is to make it potable and safe from the point of view of health to prevent spread of waterborne diseases. It has to be made acceptable to the consumer by removing tastes and odours. It must also appeal to his aesthetic sense.

The modern concept of a good water supply system is to supply safe water at the consumer's tap by (i) selecting the best available sources of supply, (ii) treating the raw water in a modern rapid sand filter plant with pre- and post-chlorination, adequate coagulation, flocculation and settling, and (iii) a well-maintained distribution system capable of supplying water equitably and at adequate pressure to the different parts of the town or city served. If the water is hard, it must be softened to bring down the hardness within permissible limits. The supply has also to be constant, *i.e.*, available for 24 hr. and not intermittent as is the case today in most towns and cities in the country where public water supply has been provided. The system should also provide for superchlorination and dechlorination for being brought into operation in emergencies.

The art of water treatment, as practized today, is not adequate to prevent transmission of diseases caused by viruses, amoebas, and nemotodes. The present water treatment plant is approaching perfection in eliminating transmission of bacterial diseases through water.

It is pertinent to observe that no change has taken place in the design of filters during the past forty years. Filter beds consisting of graded sand 24 in. to 30 in. deep with effective size from 0.4 to 0.7 mm. and uniformity coefficient 1.3 to 1.8 supported on a layer of gravel are still in use.

From the study so far made on the working of rapid sand filters abroad, it appears that an ideal filter bed would consist of a relatively coarse top layer, which will remove most of the turbidity without introducing excessive headloss and a relatively fine bottom portion which can also effectively remove the turbidity which passes to it. It is quite likely that a properly sized filter bed made of anthracite or another similar material and sand would give a better performance than the conventional graded sand bed. In some experiments carried out in the U.S.A., the best combination was found to be 8 in. of 30 to 40 mesh sand and 22 in. of 6 to 18 mesh anthracite. It is claimed that by this combination filter-water turbidity could be kept less than 0.01 p.p.m. for all raw water conditions at a filtration rate of 360 gallons per sq. ft. per hr.

The upward flow filters are in use in the U.S.S.R. and Singapore. The contact clarifier used in the U.S.S.R. is a combination clarifier and filter. It is similar to a rapid sand filter but the water in the control clarifier is filtered upwards. The raw water without any pre-treatment is injected with coagulants just ahead of the filter inlet. The filter effluent is collected by a trough at the top of the filter bed. Several advantages are claimed for this type of filter.

Robert A. Taft Sanitary Engineering Centre (U.S.A.), is studying several modifications in water filtration for over two years. The modifications taken for studies include such ideas as high rate filtration with coarse light weight media on top of sand, control of floc strength and its passage with poly-electrolytes in the filter effluents, the use of filters for flocculation of low alum doses as well as for removal of turbidity and the use of granular activated carbon in filter beds. The pilot plants have been of various sizes to determine the passage of coliform bacteria, powdered activated carbon, virus and gross turbidity through the filters.

It is not yet realized that the pre-treatment of water before its application on the filter bed should receive utmost attention. If the pretreatment is perfect, the part played by the filter itself in upgrading the water quality is insignificant. The most expensive component of a water treatment plant is the filter and its accessories. For this reason, more study on the filter is called for to make its value more commensurate with its cost.

Research problems in the treatment of water are numerous as they reflect new needs for information as well as new problems of water pollution. Improved controlled methods for coagulation dosages are needed. We have still to learn as to how to design a filter scientifically and to operate it effectively with maximum economy. Investigation is necessary to gather correct data as to the extent of the influence of water quality, management of filtration facilities, sand characteristics and hydraulic conditions of the filter itself on the rates of filtration. There are a number of other items which require investigation but I have alluded to a few of them which I consider to be of utmost importance.

Chlorination of water supplies came to the forefront during 1914 to 1918. The engineer in charge of a water undertaking is now able to supply water to the consumer which is almost bacteriologically pure. It was not until about 1880 to 1890 that bacterial analysis of water supply became available as a measure of the impurity and danger of a polluted water supply. Regular bacterial analysis carried out at frequent intervals helps to detect any falling off in quality and serves as a warning signal of danger at an early stage before disease is caused.

In European countries and the U.S.A., steps taken for treating and disinfecting water have proved successful in combating the spread of waterborne infection. In these countries, the people expect a safe water supply and feel secure in the knowledge that it has been subjected to bactericidal treatment before entering the mains. This proven high level of safety for public supply and consequent reduction in frequency of epidemics must not let the engineer forget the possibility of sporadic cases arising from untreated water.

The causative organisms of anthrax, dysentery, infectious hepatitis, typhoid, cholera, tuberculosis, etc. as well as eggs of parasitic worms can survive in sewage and river water for varying periods. Many outbreaks of typhoid have been attributed to sewage infected water supply.

The seasonal increase of typhoid in one continental city was attributed to the havesting of salads from sewage farms.

Automation of water treatment plants is on the increase both in the U.S.A. and the U.K. and it is likely that automation will play an important role in water treatment as it is doing in other industries.

What can we look forward to in the future? With the tremendous research being done on Resin Technology, we can look forward to new and improved resins permitting higher flow rates and continuous processes. The trend towards automation will continue at an even greater rate with the developments in the rapidly expanding electronic field. When we consider the reliability that is now being built in complex control systems in this missile age, the automation of water treatment process will not present any serious problem. This I believe will be the greatest contribution in our time.

While remarkable progress is being made in the processes of water treatment, we should not forget that water supply is not available in some parts of the world in sufficient quantities to meet domestic, industrial and other beneficial requirements. For this purpose, the following investigations are in progress in the U.S.A. :

(i) Charting courses of underground rivers ;

(ii) Cloud seeding ,

(iii) Reduction of water losses caused by evaporation, seepage and eroded land surfaces ;

(iv) Desalting of salt waters ;

(v) Pollution of abatement and reclamation of sewage effluent ; and

(vi) Reuse.

We have however yet to learn a good deal regarding the economic designs of water treatment plants to suit different types of water. The operation of plants is much neglected. The operation of plants is as important as their design. The public health engineers must make every effort to change the 'art' of water treatment into a perfect science.

Sewage treatment

I now come to the subject of drainage or sewerage. Mr. Rawlinson (afterwards Sir Robert Rawlinson), the first Chief Engineer of the Local Government Board of Great Britain, is generally accepted all the world over as the father of modern public health engineering.

The earliest attempts at treatment of sewage were confined to the application of sewage to land. As schemes grew, difficulties arose in England owing chiefly to the very large area of land required especially on clay soils, and the engineer proceeded to look first for means of lightening the load on the land and later for a substitute for land treatment.

The first stage in sewage purification was to provide settling tanks to remove as much of solids as possible. In some cases, chemicals were added to assist and hasten precipitation. It proved to be costly and accentuated the problem of sludge treatment and disposal.

The next stage was the introduction of artificial filter bed—intended at first merely as a strainer but developed later into a biological filter on which the purifying organisms. were encouraged to grow.

Later, the activated sludge was developed which is being used largely though not to the exclusion of other methods, in foreign countries. There are a few activated sludge plants in India and the bio-filter is being used for purification of sewage on a large scale. In Great Britain, it is found that from an economical point of view there is nothing to choose between trickling or biofilters and the activated sludge. It follows that every case must be considered independently.

It is believed that bacteria beds require less skill in operation than the activated sludge plant. It is the susceptibility of the activated sludge plant to sudden overloads of strong sewage such as are encountered when a sudden discharge of strong trade effluent is received at the works without adequate dilution which renders the activated sludge plant more difficult to supervise.

In deciding which type of biological treatment to adopt, due consideration should be given to the means available for treatment of the sludge—since the activated sludge is more difficult to dewater than the humus sludge produced by a bacteria bed system. While designing the filter beds, sufficient fall should be ensured to enable the system to operate without pumping. Filter beds are not economical if the depth is less than 5 ft. A further head of 2 ft. is needed for the effluent pipes to convey the effluent to the final settling tanks. The walls of filter beds do not normally have to withstand great hydrostatic pressures, but in the design an allowance should be made for the expansion of the medium which can exert considerable outward thrust. If convenient, the ground level surrounding the beds should be kept well down the walls to permit easy ventilation to the lower levels of the media. Where the beds are to be built below ground level, provision must be made for ventilation by ducts or pipes down the walls.

As regards the size of the filtering medium, it is not considered advisable to have grades less than 1 in. as the small media soon become choked and 'ponding' develops. The general practice is to use media about 1½ in. to 2½ in. grade with perhaps a layer of large size at the floor level.

Most types of the activated sludge plants require fairly deep tank construction which, in the type of subsoil conditions, frequently found on sewage works, may prove very costly.

The final settling tanks are usually circular for medium and largesize plants. On small works, Dortmund type tanks are sometimes used. Extended aeration, stabilization, oxidation ponds and oxidation ditch for small installations are also being perfected.

Refinement in treatment methods created the problem of the treatment of sludge, *i.e.*, the deposits at the bottom of settling tanks. This problem is as important as the purification of sewage.

The purposes of sludge treatment are to reduce the volume, to stabilize the organic matter and destroy pathogenic organisms.

The methods of sludge treatment most frequently employed are anaerobic biological digestion followed by partial dewatering on sludge drying beds, or by the use of vacuum filters. The partially dewatered sludge from vacuum filters is sometimes reduced to an inert ash by incineration.

Other less frequently used processes include thickening, elutriation, heat drying, biological flocculation and lagooning. Two new processes which are in use in the present-day practice are the 'Zimmarman' process and the 'Atomized Suspension Technique'.

The discharge of treated or partially treated effluents from sewage plants into streams and rivers has created the problem of water pollution. This means that the present methods of sewage treatment require modifications and improvement.

The standards of 20 and 30 p.p.m. laid down by the British Royal Commission for the quality of sewage effluents to be discharged into streams and rivers are not suited to the present time even in England due to a reduction in the dilution available because, (i) the volume of effluents discharged into rivers has increased, (ii) the rivers have decreased in volume because more water is being abstracted for domestic, industrial and agricultural purposes, (iii) the land drainage work, carried out to prevent flooding and water logging of the land, causes rainfall to pass more quickly to the sea, and (iv) with the increasing development of land for housing, the rain which falls on impervious surfaces drains away more quickly. Besides, the treatment must be such as to make the final effluent fit for 'reuse'. To achieve this objective, advanced methods of tertiary treatment such as adsorption, foam separation, electrodialysis, evaporation, liquid extraction and oxidation are under investigation.

The quality requirements for reuse vary widely. Sometimes B.O.D. plays a part but often other characteristics are more important. For example, water that contains gross solids or tends to develop slimes would be undesirable for reuse in most cooling systems. Colour, hardness, concentration of specific minerals and ions, temperature, *p*H, turbidity, salinity, uniformity of quality—any of these may be determining characteristics for a particular use. Sometimes, further treatment to remove the objectionable materials may be warranted.

This change from pollution control to effluent reuse was emphasized by Martin Lovett in his presidential address to the Institute of Sewage Purification (England) in 1961. This change was referred to again in 1962 by Arnold Holroyd in his presidential address to the same Institute. He said 'the important problem today is not that of pollution in its older sense but rather of how completely we must reclaim water before employing it for other purposes'. He then went on to refer to the pincer movement of abstraction of water on the one hand and its substitution by reclaimed water on the other. Whatever these changes may be, he continued, 'It is clear that the members of our Institute must play a large part in meeting their consequences. It is not too soon to think about these changes'.

A good deal of research in the methods most suitable to meet our requirements is necessary.

Water pollution

The prevention of water pollution is also an integral part of the broader problems of water resources development and conservation. It is also an inseparable part of environmental health protection, because clean water is essential for life, industry and other beneficial uses.

Before the location of a particular industry is decided, the main factors usually considered are cost of land, transport facilities, water, power and availability of labour but the main problem as to how to dispose of the effluent is not at all considered. This is very important because in our country, barring a few, most of the rivers get dry in the hot weather and the dilution required for purification of the effluent discharged into our streams and rivers is not adequate. It is found in England that while enforcing the enactment for water pollution control, small industries located on the banks of the rivers had to be shifted. It is therefore necessary to stress that this aspect should be thoroughly studied before any site for the location of an industry is selected.

As water is a strategic element in the economy and is related, in some degree, to every major activity of life, problems created by water pollution have to be solved by harnessing old skills, bringing in new talents and changing some of the ways of doing things.

For this, vigorous research is necessary. Research is not a luxury or a voluntary activity but an integral and strategic activity in the mode of life which is increasingly shaped by science and technology.

The United States Public Health Service published in 1958, an inventory indicating the amount and kind of research under way in the water and water pollution control fields. The service also planned to provide basic data to constitute the first step in estimating research progress and needs.

Some of the problems suggested for research in the water pollution field are (a) reclamation and utilization of waste waters and the ecology of receiving water, (b) development of improved methods for sludge concentration, (c) determination of toxicity in natural water, and (d) physiological aspects of water quality to understand the significance of the effect of minerals, trace elements, insecticides and organic substances in potable water.

The National Conference on Water Pollution held in December 1961 at Washington laid emphasis on research needs. One of their recommendations was as follows:

> 'We need to increase our research effect on the behaviour and fate of newly recognized viruses. We need to develop more effective means of removing pollutants from water in municipal and industrial water treatment plants, more effective process control of industrial waste discharges, better recovery or utilization of industrial process wastes and more sophisticated industrial waste treatment process'.
>
> 'To discover and develop the required technologies will demand a major coordinated research programme utilizing the best minds in the country and attracting physicists, physical, organic and bio-chemists, toxiologists, hydrologists, economists, geographers and anthropologists who have not been up to now seriously engaged in water pollution control'.

Collection and disposal of refuse

The problems of collection and disposal of refuse do not appear to have received adequate attention in the country. The methods followed for collection and disposal in major cities in the country are unhygienic and unsatisfactory. Public cleansing plays the same role in the promotion of public health as the provision of protected and adequate supply of drinking water and the hygienic disposal of excreta and the 'spent' water of the community. For the past 20 years or so, major cities in advanced countries have been making strenuous efforts to make this service as hygienic as possible compatible with economy. Firstly, as it is one of the most costly services, efficiency and cost must be kept in proper perspective; secondly, it is a modern technique and as such it needs to be dealt with strictly on business lines and this can only be done by strict and correlating cost returns for each phase of its operation. Public cleansing includes four interdependent stages of storage, collection and haulage and transport to the site of disposal and disposal proper. The Panel appointed by the Committee on Plan Projects on this subject has recommended the setting up of a committee to go into this question and make recommendations for the improvement of this service.

Air pollution

Industrialization has also created the problem of air pollution. It has become acute in the advanced industrialized countries of the world. Legislation in most of these countries has been enacted for its control. Air pollution has been the cause of death in a number of verified cases.

Air pollution not only causes illness and death but it degrades urban environment. Its harmful effects include physiological irritation, cracking of leather, unpleasant odour and decreased visibility as in Los Angeles. It damages vegetation and the physical fabric of a city causing a sense of stifling and confinement.

The air pollution problem in its broad aspects has not only a health but also political and social significance. It affects the rubber tyred vehicles, as it is found to crack leather as already mentioned.

In the U.S.A., research is in progress to observe the effects on laboratory animals of breathing the same air breathed by people in Los Angeles where an automobile exhaust has created a great health problem. The test animals breathe the air at special sites located at varying distances from the heavily travelled thoroughways, a control group of similar animals are living in purified air from which contaminants have been removed. This study represents the largest research effort of its kind yet undertaken in the field of air pollution.

So far, the National Air Sampling Network in the U.S.A. was concerned with the collection of solid particles in the atmosphere. The network has now expanded its research efforts to include the sampling of gases. Other studies in the U.S.A. are pointing the way to possible changes in automotive engine design or petroleum use, to lessen pollution with the least possible economic penalty to the manufacturers and the public.

At the same time, meteorologists are seeking to develop methods of forecasting weather conditions which are conducive to pollution build-ups in a given area.

As our country is being industrialized rapidly, air pollution control will be found necessary in the near future to protect pubblic health. Some kind of network must be started for collecting the data and for fixing standards to suit local conditions. The principal weather elements effecting air pollution are wind, speed and direction and vertical temperature distribution. The wind speed and direction are influenced by topography.

It has also been realized that there are a number of fields which need to be explored in the control of air pollution and the work has been developing very intensively under the following headings :

(1) The development of instrumentation for the continuous recording of the many parameters, ozone, aldehydes, oxides of nitrogen, oxides of carbon, hydro carbons, which need to be studied.

(2) Studies of the chemical composition of the atmosphere of large cities with a view to finding out which gaseous compounds are common to all cities or at least to many cities and which are peculiar to some cities. In this work, the mass spectrometer and the infra red spectrometer havedeen the most valuable tools, the one assisting the other.

(3) Attempts to unravel the complex chemical reactions which apparently give rise to the type of pollutant that causes eye-irritation are being made in Los Angeles. This problem is being approached both by the synthetic method, in which compounds are produced and their biological effects are tested and by the analytical method, in which attempts are made to separate out of normal air, some components which will produce specific biological effects.

(4) Toxological studies of the effects of various materials particularly ozone on animals and population studies in which attempts are made to co-relate general population symptoms with the rise and fall of various factors in city air. Here of course, the industrial hygiene experts are coming into closer contact and cooperation with the workers on air pollution than they

did before and it is evident that air pollution studies are an extension of industrial hygiene.

(5) Metereological studies to develop a sound knowledge of the nature of air movement in the first few hundred feet above a city, the mechanism by which pollutants are dispersed above a city and the sort of measurement which will most reliably indicate what degree of dispersal rate is in process at the time of the measurement.

(6) Study of damage to vegetation as a means both of learning how the damage takes place and of being able to use specific plants as a form of instrument to indicate the degree of pollution which is present at any time.

(7) Development of methods for the control of effluent from all types of industry and all processes which may produce effluent including domestic burning of coal and burning of petrol in private automobiles.

It has been established that air pollution cannot effectively be controlled by placing the control in the hands of the public health organizations of a city, a state or a country. The requirements are diverse and complex and a team of trained minds is necessary. Medical, physical, chemical and engineering abilities are needed and must be supplied if the job is to be done effectively. A well-planned effort is required in every country of the world.

The rapidly expanding applications of radio-active materials and of nuclear energy must inevitably lead to a vast increase in radio-active pollution of the atmosphere unless effective preventive measures are taken without delay. Such measures as are essential for safeguarding the health of both radio-active workers and the population at large, must be conceived as part of a programme for the control of air pollution in general.

Measures for preventing possible harmful effects of radio-active pollution of the atmosphere must be based on the fundamental principle that the prescribed maximum permissible doses should on no account be exceeded. The first requirement is therefore a rigorous monitoring system to determine the nature and the level of radio-active contamination, effective methods can then be applied.

Need for Consulting Engineers

I would now like to say a few words regarding the necessity of encouraging Consulting Engineers in the country to fulfil their role in the designing of works of all sorts within the sphere of public and private sectors, government departments and local authorities. The announcement made by the Government of India a few months ago, that the work of preparing and completing the Bokaro Steel project was entrusted to a firm of Indian Consulting Engineers aroused great enthusiasm in the engineering world of the country. It is not however known why Government are now thinking of getting this work done through the Engineers of the Soviet Union. This report is very disturbing especially to the younger engineers in the country.

Status of the Public Health Engineer

I would also like to say something regarding the status of Public Health Engineers in the country.

It is unfortunate that an impression still prevails in our country that Public Health Engineering does not need any special training and can be practised by any engineer, civil, mechanical or electrical. New developments have taken place so extensively during the last 10 to 15 years that the Public Health Engineering has become a specialized science and the days are gone when engineers had only to invite tenders and leave the designing and execution to specialist equipment companies. What else could be the reason that until a few years ago schemes for water supply and sewage treatment were the monopoly of a handful of firms? I recall the days when the tender for a complete water and/or sewage treatment plant consisted of one or two pages couched in high sounding but vague language, leaving all the design criteria to the tenderers.

Unless we assign to the trained Public Health Engineer his rightful place, we will not develop any initiative in the field of Public Health Engineering. A question may be asked as to how we can give the Public Health Engineer his rightful place? The present position has perhaps arisen as a result of Government attitude. Government who are the largest single employer of Public Health Engineers have not set a worthy example. Somehow Public Health Engineers came to be excluded from the All-India Service of Engineers. How can we expect to attract good talent to this branch of Engineering if we do not give proper recognition to them? This matter has been represented to the Ministry of Health of the Government of India and it is understood that the Ministry are trying their utmost to have Public Health Engineers included in the list of Engineers of the All-India Service.

It has been brought to our notice by post-graduate Professors of Public Health Engineering that the standard and mode of teaching this subject at the undergraduate level leaves much to be desired. Often the postgraduate students have to be made to unlearn the wrong concepts picked up by them from their undergraduate days, when they were taught this subject by general civil engineers with no special training in Public Health Engineering. It is obvious that we need well trained and specialized persons to teach this subject at the undergraduate level so that the quality of teaching will be good and first-rate students would be attracted to pursue higher studies in this field.

I am afraid I have exhausted your patience by dwelling upon the various aspects of our community life affecting the industrial and economic progress and public health. I shall not bore you any more. I would however like to make an appeal to my brother engineers to ward off 'obsolescence' by continuous study, research and development. It is only by these measures that an engineer can continue to make himself fully useful to the community and the nation. In support of my appeal, I shall reproduce what an eminent engineer Dr. R. G. Folson, President of Renissclear Institute, said in his address to a group of engineers in 1962.

> 'Engineers of tomorrow will be made obsolete by the facts discovered today, unless they make up their minds to be students all their life. The difference between the education that many engineers experienced previously and the education that we are attempting to give today, is that when you went to college you were trained to be guides to take people over well travelled paths, whereas today, we are trying to give people the necessary training so they can become leaders in uncharted routes.'

Conclusion

I shall now conclude this lecture by paying my respectful tribute to the illustrious engineer, industrialist and administrator in whose memory these lectures are arranged every year. May I express the hope that his life of dedication to the service of India in various fields of human activity will inspire us to utilize our technical knowledge, wide experience and creative ability to accelerate the scientific, technological, industrial and economic progress of India ?'

Summaries of Papers Published in the Journal, vol. 45, no. 8, pt. EL 4 and HI 2, April 1965

ELECTRICAL ENGINEERING DIVISION

Radio Interference Parameter in the Design of Extra High Voltage Transmission Line

Dr. H. V. Gopalakrishna
Member

As the voltage for overhead electric power transmission is raised, the consideration of radio influence becomes important. This paper provides a practical understanding of the radio influence of extra high voltage transmission lines and correlates theoretical calculations with experimental data obtained in the laboratory. The techniques outlined can be used for selecting conductors for electric power trans mission at extra high voltage.

Operation of Induction Machine with Double Unbalance

I. J. Nagrath
Non-member
and
T. R. Sahni
Non-member

The analysis of a balanced induction machine with unbalanced impedances connected on both sides of the air gap is carried out with the help of symmetrical components. Expressions for steady torque, r.m.s. values of currents and voltages, and the peak voltages have been derived. It is shown that in the case of general unbalance the derivation of an equivalent circuit and a solution is not possible. However, an equivalent circuit can be obtained in the case of symmetrical double unbalance, *i.e.*, when the external impedances are symmetrical about one of the lines in both the stator and rotor circuits. A study is carried out for the variation of steady torque, r.m.s. currents and voltages, and the peak voltages with motor speed for practical cases of double impedance unbalance. The stator and rotor resistances is taken into account in the study and the iron losses neglected. The effect of variation of stator and rotor resistances with frequency is taken into account. Because of a number of assumptions made in the analysis, experimental verification of theoretical analysis is also presented

Limiting Transformer Noise

S. K. Goyal
Non-member

The problem of transformer noise or hum has attracted attention of research workers the world over. Large increase in the size of transformers in recent times has aggravated the problem of noise and vibration. Vibration caused by transformer hum is transmitted to the structures in the vicinity and much damage may be caused to the structures if they form a resonant vibrating system. In this paper, the factors responsible for transformer hum are analyzed and the methods for limiting the noise in a transformer described.

HINDI SECTION

Relationship between the Size of the Foundation Model and Size of the Tank in which Experiments are Performed in Soil Mechanics

Dr. Janardan Jha
Associate Member

Theory of modelling is very developed in hydraulics, aerodynamics, etc., but it is not so developed in soil mechanics. In the international conferences, it has been stressed that the theory of modelling should be developed for the solution of the problems of soil mechanics. Whenever we try to perform experiments in the laboratory on models, we try to keep the model in a tank. The friction between the soil and the tank distorts the result. Deformations taking place in an earth mass under a loaded foundation are photographed through transparent glass. The curves are again distorted by the presence of friction between soil and glass.

An effort is made to find out the coefficient of friction between different types of sand and glass by means of a new apparatus. It is also found that by using two layers of transparent polythene sheets with oil in between them reduces the value of coefficient of friction considerably. On the basis of theoretical consideration and using the value of coefficient of friction, the relationship between the size of the model and size of the tank has been found out for different types of soil problems. If a proper relationship is maintained then the effect of friction can be neglected.

Asian Highway—Journey from Bazargan to Dacca

W. Tanzer
Non-member

The Asian Highway is a brand-new name for one of the oldest roads in the world, the ancient caravan route between Asia and Europe. ECAFE (the Economic Commission for Asia and the Far East) is giving a face-lift to the roads on which the international camel traffic moved in Asia before it was put out of action by steamships and the Suez Canal. The author, who is the chief of the United Nations Information

Service with ECAFE, describes in this paper an account of the journey undertaken by a TV and radio team which travelled a distance of over 10,000 km. in 66 days of which 7,500 km. were on the Asian Highway in Iran, Afghanistan, Western Afghanistan, India and East Pakistan. From Bazargan at the Turkish-Iran border, the party travelled to Mashad a holy city near the Afghan border and then to Kabul through Herat and Kandahar. The paper gives an interesting account of the route, condition of the roads, and construction work under progress.

Science in Building

Rabinder Singh
Non-member
and
G. C. Mathur
Non-member

The paper highlights the role of science in building and housing. The magnitude and importance of construction work in the programme of development as envisaged in the Five Year Plans and the building problems are mentioned. The importance of basic and applied research in the field of building and the agencies for research and application of results of research have been briefly mentioned. As a result of research, outstanding developments in building have been described under the following fields : planning of building, architectural designing, structural designing, building materials, building techniques and building operations. For bringing out cost-reduction and improvement in building, the scope of research in laying down space norms, modular planning and standardization, evolving functional architecture and modern trends in design, economical development of new materials, developing framed structure and new structural forms, improvements in traditional materials and introduction of new materials, new construction techniques as regards foundations, walling and roofing, and better building methods, has been dealt with. Special research problems of indigenous character have been indicated.

INSTITUTION NOTICES

Seminar on 'The Role of the Engineer in the Fourth Five Year Plan', 46th Annual Convention, Bihar, February 1966

It is proposed to hold a Seminar on 'The Role of the Engineer in the Fourth Five Year Plan' at the time of the 46th Annual Convention which will be held in Bihar (at Patna or at Ranchi) in February 1966. Corporate Members who would like to propose topics for inclusion in the Seminar are requested to send their suggestions to the Assistant Secretary (Technical) at the address of the Headquarters in Calcutta.

The Convenor for the Seminar will be Brig. M. K. Rao, (M.), Member of the Council from the Electronics and Telecommunication Engineering Division. His address is : Headquarters Southern Command, B.E. Office, Poona 1. Members wishing to correspond in connection with the Seminar are requested to write to him direct with copies of their letters to the Secretary at the Headquarters.

Misdemeanour in the Institution Examinations

The Council have decided to cancel the results of the following candidate for the May 1964 examinations and that he be warned for not submitting the supplementary answer book along with the main answer book at the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 9048	2759 A	K. Raman

The Council have dicided to cancel the results of the following candidate for the May 1964 examinations and debar him from appearing in the two immediately following examinations, *i.e.*, up to and including May 1965, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 33092	1069 A	Sudhir Kumar Pramanik

The Council have decided to cancel the results of the following candidate for the May 1964 examinations and debar him from appearing in the three immediately following examinations, *i.e.*, up to and including November 1965, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 51343	1455 NA	Sarat Chandra Das

The Council have decided to cancel the results of the following candidates for the November 1964 examinations and debar them from appearing in the one immediately following examination, *i.e.*, up to and including May 1965, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 54509	2940 NA	Soumendu Sekhar Ghosh
S. 44282	2926 NA	Shiba Pada Bhattacharya

The Council also decided to cancel the results of the following candidates for the November 1964 examinations and debar them from appearing in the three immediately following examinations, *i.e.*, up to and including May 1966, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 41076	5269 NA	Darshan Singh
S. 50111	5305 NA	Hardev Singh Sra
S. 49893	5512 NA	Ujagar Singh Karail
S. 41804	5225 NA	Narinder Kumar Puri

The notice on page 15 of the February 1965 *Bulletin* may please be read as follows :

The Council have decided to cancel the results of the following candidates for the November 1963 examinations and debar them from appearing in the two immediately following examinations, *i.e.*, up to and including November 1964 examinations, or misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 26503	1538 B	Garla Ananda Sekhar
S. 38331	2173 NA	Harbir Singh

The Council have decided to cancel the results of the following candidates for the November 1963 examinations and debar them from appearing in the three immediately following examinations, *i.e.*, up to and including May 1965 examinations, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 44966	2207 NA	Sudershan Lal Bhatia
S. 45515	2292 NA	Tarlochan Singh

The Council have decided to cancel the results of the following candidates for the May 1964 examinations, and debar them from appearing in the two immediately following examinations, *i.e.*, up to and including May 1965 examinations, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 9820	658 B	Kidar Nath Aggarwal
S. 17334	897 B	Rajinder Singh Khosla

The Council have also decided to cancel the results of the following candidates for the May 1964 examinations, and debar them from appearing in the three immediately following examinations, *i.e.*, up to and including November 1965 examinations, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 35414	1254 A	Santokh Singh Paul
S. 26588	1525 A	Mukh Lal Sharma
S. 25359	2292 A	S. D. Upadhyay
S. 33011	912 NA	Tara Pada Ballav
S. 36144	3607 NA	Narinder Singh Mangat

General Engineering Part of the *Journal*

A new addition to the *Journal*, namely, a Part devoted to General Engineering, is being introduced, from the month of September 1965. Four issues will be published each year.

This Part of the *Journal* will be devoted to papers and articles of general engineering interest.

As previously announced, Corporate Members are eligible to receive two Parts of the *Journal* free of cost, one pertaining to the Division to which they are attached and one other Part of the *Journal* of their choice. Therefore, Corporate Members who wish to receive the *Journal* Part pertaining to General Engineering may apply to the Secretary in writing, provided they are not receiving already two Parts of the *Journal*. Corporate Members already receiving two Parts of the *Journal* may, however, forego one of them and opt to receive the General Engineering Part.

New Telephone Numbers of the Institution

Consequent upon the installation of a new PBX telephone board, the exchange number of the Institution has changed from 47-4344, 45, 46 (3 lines) to 47-3362, 63, 64, 65 (4 lines). The line having the number 47-7370, so far a direct line, no longer exists.

The new installation does not, however, effect any change in the exchange number of the Examinations Department. That is to say, all calls meant for the Examinations Department will continue to be attended by 47-2034.

The change may please be noted for future guidance.

Draft Indian Standards

The following draft Indian Standards have been issued recently.

1. Draft Indian Standard Specification for Waste Plug and Accessories for Sinks and Wash Basins—Doc : BDC 3(92).

This standard covers the requirement for constructions, materials, manufacture and finish of waste plug, chain and stay suitable for fitting to sinks and wash basins complying with I.S. 771-63 and I.S. : 2556-63.

Members may send their comments on the above draft standard before May 20, 1965, to Shri B. B. Rau (*A.M.*), Deputy Assistant Director-General, Public Health Engineering, Central Public Health Engineering Organization, Wing 7, Patiala House, Annexe, Tilak Marg, New Delhi 1, who is the Institution representative on the Sectional Committee dealing with this Standard.

2. Draft Indian Standard Method of Testing for Soils—Doc : BBC 23.

This Standard lays down the determination of total soluble solids in soils both by gravimetric method and conductometric method.

Members may send their comments on this Standard to Shri C. G. Swaminathan (*A.M.*), Assistant Director, Central Road Research Institute, New Delhi 20, who is the Institution representative on the Sectional Committee dealing with this draft standard.

Copies of the draft Standards may be obtained from the office of the Indian Standards Institution, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 1, or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay 1 ; 11 Sooterkin Street, 3rd Floor, Calcutta 13 ; 14/69 Civil Lines, Kanpur ; or 1/12 First Line Beach, Madras 1.

INSTITUTION NEWS

Biography of General Sir Arthur Cotton

A biography of General Sir Arthur Cotton, who has been called the 'Father of Irrigation' in Southern India, written by his daughter, Lady Hope, was first published in 1900 in England. This biography has now been reprinted by this Institution in homage to the memory of one of the greatest engineers of the last century who has been responsible for the prosperity of extensive areas in South India and as a source of inspiration to coming generations of India's engineers. This decision to reprint the book was an outcome of the celebration by the Andhra Pradesh Centre of this Institution on 25th August, 1959, on the passing of the first hundred years from the completion of the Godavari and Krishna river irrigation projects in 1859, and in that function, the present Union Minister for Irrigation and Power, Dr. K. L. Rao, who was then the President of this Institution, said that they were paying homage to the memory of one of the greatest engineers of the last century.

The cost of this book is Rs. 20 plus forwarding charges. Orders may kindly be sent to the Technical Officer (Scientific) at the address of the Institution.

Donations by members to Headquarters Building Fund

A list of members who have contributed to the Fund as on February 28, 1965, is given below. These donations are gratefully received.

Member	Donation
Shri R. Singh (*Student*)	.. Rs. 5.00
Shri V. S. Bhayana (*Student*)	.. Rs. 10.00
Shri G. C. Chaudhuri (*Student*)	.. Rs. 10.00
Shri M. M. De (*Student*)	.. Rs. 10.00
Shri H. C. Srinivasiyengar (*Student*)	.. Rs. 5.00
Shri G. C. Varier (*Student*)	.. Rs. 10.00
Shri S. V. Patil	.. Rs. 10.00
Shri J. P. Ganguly (*Student*)	.. Rs. 5.00
Shri A. Ramasubbaiar (*Student*)	.. Rs. 5.00
Shri H. H. Tejani (*Student*)	.. Rs. 5.00
Shri B. L. Bhatnagar (*Associate Member*)	.. Rs. 10.00
Shri K. P. Sharma	.. Rs. 5.00
Shri R. Arvamuthan (*Graduate*)	.. Rs. 5.00
Shri L. B. S. Rao (*Student*)	.. Rs. 15.00
Shri S. N. Gupta (*Associate Member*)	.. Rs. 10.00
Shri G. G. Desai (*Associate Member*)	.. Rs. 20.00
Shri G. Dayal (*Associate Member*)	.. Rs. 10.00

Shri A. B. Yeolekar (*Student*)	.. Rs.	5.00
Shri S. M. Gangal (*Student*)	.. Rs.	10.00
Shri S. P. Joshi	.. Rs.	10.00
Shri V. C. Sodhani (*Student*)	.. Rs.	5.00
Shri Nand K. Poddar (*Student*)	.. Rs.	5.00
Shri M. S. N. Banerjee (*Student*)	.. Rs.	5.00
Shri R. S. Gajjar (*Associate Member*)	.. Rs.	50.00
Shri P. J. Changule (*Student*)	.. Rs.	10.00
Shri Y. V. S. Ramamurty (*Graduate*)	.. Rs.	10.00
Shri D. N. Pandey (*Student*)	.. Rs.	10.00
Shri J. V. R. Bhatia (*Student*)	.. Rs.	5.00
Shri Sujit K. Majumdar (*Student*)	.. Rs.	10.00
Shri S. Rajagopal (*Graduate*)	.. Rs.	10.00
Shri A. M. Senapaty (*Student*)	.. Rs.	5.00
Shri B. N. Marigowda (*Student*)	.. Rs.	10.00
Shri K. U. M. Rao (*Student*)	.. Rs.	5.00
Shri G. K. Reddy (*Student*)	.. Rs.	5.00
Shri P. Sethumadhavan (*Student*)	.. Rs.	5.00
Shri R. Krishnan (*Student*)	.. Rs.	15.00
Shri N. K. Guha Niyogi (*Student*)	.. Rs.	5.00
Shri B. C. Kothurashettar	.. Rs.	5.00
Shri M. V. Amin (*Associate Member*)	.. Rs.	201.00
Shri M. P. Kini (*Student*)	.. Rs.	5.00
Shri A. H. Khan (*Member*)	.. Rs.	10.00
Shri G. T. Gokhale (*Member*)	.. Rs.	100.00
Shri H. Singh (*Student*)	.. Rs.	5.00
Shri K. V. Kudra (*Associate Member*)	.. Rs.	15.00
Shri K. K. Srivastava (*Student*)	.. Rs.	17.00

NEWS AND NOTES

The Indian Hot Dip Galvanized Association

The Indian Hot Dip Galvanizers Association has recently been formed and its first meeting was held on March 8, 1965, in Calcutta. Its membership comprises about 50 leading galvanizing firms drawn from all parts of India. The Association is a non-commercial, non-profit making body and will be predominantly devoted to technical matters. It will not be a medium for making representations about government policies and on commercial matters, such as quotas, licences, etc. One of the important functions of this organization is to provide technical advice and information on the process of galvanizing and the use of galvanized coatings, to both users and manufacturers. The Association will also hold seminars, conferences and refresher courses primarily for the purpose of improving the techniques and promoting the economical utilization of zinc.

The secretariat of the Association will be at Indian Lead Zinc Information Centre, 5A Lord Sinha Road, Calcutta 16, to which enquiries may be addressed.

FORTHCOMING CONFERENCES

Symposia on (i) 'Model and Prototype Conformity', and (ii) 'Modern Trends in Hydraulic Engineering', Poona, 1966

The Central Water and Power Research Station, Poona, will be completing 50 years of its existence in 1966. To mark this occasion, it is proposed to organize two Symposia on (i) 'Model and Prototype Conformity' and (ii) 'Modern Trends in Hydraulic Engineering' in early 1966.

Members who wish to contribute papers to the Symposia should send a summary of their proposed paper to the Director, Central Water and Power Research Station, 20 Bombay-Poona Road, Poona 3, as soon as possible.

International Conference of the International Federation for Housing and Planning, Orebro, June 27-July 2, 1965

An international Conference of the Federation of Housing and Planning at Orebro, Sweden, will be held from June 27 to July 2, 1965. The theme of the Conference is 'Growing Space Needs in the Urbanized Region'.

Further details can be obtained from the International Federation for Housing and Planning, 2 Alexanderstraat, The Hague, Netherlands.

1965 Summer Conference on 'Plastic Design of Multi-storey Frames', Lehigh University, U.S.A., August 24-September 1965

A Summer Conference on 'Plastic Design of Multi-Storey Frames' is being organized by the Lehigh University, U.S.A., the American Iron and Steel Institute, and the National Science Foundation, U.S.A., in cooperation with the American Institute of Steel Construction, the American Society of Civil Engineers, the American Society for Engineering Education, the Navy Department, and the Welding Research Council, U.S.A. The Conference will be held from August 24 to September 2, 1965. The programme, consisting of lectures and laboratory demonstrations, will provide background for the application of plastic design to multistorey building frames. Lecture topics covered will include: plastic design concepts (brief review) behaviour of structural components, analysis of sub-assemblages frame stability, design of braced high strength steels and composite design. Demonstrations will include tests of full-size three-storey frames, loads being increased through the elastic and plastic ranges to illustrate the accuracy with which the maximum strength of a multistorey frame may be predicted.

Further details can be obtained from Mr. George C. Driscoll (Jr.), Research Associate Professor, Chairman, Summer Conference, Lehigh University, Bethlehem, Pennsylvania, U.S.A.

IFAC/IFIP Symposium on 'Microminiaturization in Automatic Control Equipment and in Digital Computers', Munich, October 21-23, 1965

The German VDI/VDF—Fachgruppe Regelungstechnik is organising a Symposium on 'Microminiaturization in Automatic Control Equipment and in Digital Computers' to be held in Munich, Germany, from October 21 to 23, 1965. As the topics for the Symposium overlap the activity of the International Federation of Information Processing (IFIP), they have accepted to sponsor the Symposium. The topics on which papers may be offered are listed below.

(1) New pneumatic and hydraulic components

(2) Optical components: (i) Electro-optical components, (ii) Electroluminiscence, and (iii) Miniature optics.

(3) Storage components: (i) Ferrite storage (ii) Magnetic film storage, (iii) Ferroelectrical storage and (iv) Cryogenic storage.

(4) Integrated circuits in planar, thin film and hybrid techniques with: (i) Injection transistors, (ii) Field effect transistors, and (iii) Polycrystalline semiconductors.

(5) Construction and interconnection techniques of miniaturized components.

(6) Microminiature measuring devices and transducers for mechanical, acoustical, optical, magnetic, electrical and thermal variables as well as for the determination of radioactivity and composition of substances.

(7) Trends and limits of microminiaturization. Expansion of the application field through higher reliability and speed, smaller volume, simplified construction of extensive systems, and more favourable physical characteristics.

Offers of papers together with an abstract (10 lines) should be sent to the Secretary as early as possible and the full manuscript by not later than July 10, 1965.

Further particulars can be obtained from Gerd Müller, Secretary IFAC/IFIP Symposium, P.O. Box 834, Karlsruhe, Germany.

The 1965 Building Exhibition, Olympia, London, November 17-December 1, 1965

The 1965 International Building Exhibition will be held at Olympia, London from November 17 to December 1, 1965. A conference is being organized to take place at Olympia during the Exhibition's run, and a number of associations and professional societies will be arranging meetings.

Symposium on 'Tall Buildings' University of Southampton, April 13-15, 1966

A Symposium on 'Tall Buildings' with Particular Reference to Shear Wall Structures' will be held in the Department of Civil Engineering, University of Southampton, Southampton, U.K., from April 13-15, 1966. The recent large increase in the number of tall buildings using cantilever walls, infilled frames, and heavy service cores to resist lateral forces has focussed attention on the importance of learning more about the detailed behaviour of such structures. The aim of the Symposium is to bring together practising and research engineers with a common interest in tall buldings, in order to examine the problems which confront the designer, to present and discuss the results of recent related research, and by the mutual exchange of ideas, to stimulate the future of both design and research in this field.

Papers are invited on both theoretical and practical aspects of the subject. Authors should send the title, a brief summary, the estimated length of their proposed paper to the organizing Secretaries as soon as possible. Manuscripts will be required before the end of October 1965. Further particulars can be obtained from the Symposium Joint Secretary, Department of Civil Engineering, University of Southampton, Southampton, U.K.

BOOK ACKNOWLEDGMENTS

1. **Concrete Construction.** B. Peschke. *Asia Publishing House*, Bombay, Rs. 4.50. 1964, 79 pages.

Starting with general comments on the building material 'concrete', the later parts of the book are devoted to the work of the concretor. The different operations involved such as mixing, application and treatment, formwork, and reinforcing are explained. Extensive theoretical explanations, especially in the mathematical, physical and chemical fields, have been dispensed with in the book. Numerous illustrations included in the book enhanve its utility.

2. **Construction of Roads and Tracks in Rural Areas.** J. Jahne. *Asia Publishing House*, Bombay, Rs. 5.00, 1964, 96 pages.

This book deals with the construction of roads and tracks in rural areas, with emphasis on tropical and semi-tropical conditions, where the use of agricultural machines is of paramount importance. Details of route selection, dimensions of rural roads and tracks, paving of roads, thickness of pavements, bicycle tracks and footpaths in rural areas, and roadside planting are given in its different chapters. The last part of the book deals with the control and maintenance of roads in rural areas and use of roads.

3. **The Lathe.** W. Schlayer. *Asia Publishing House*, Bombay, Rs. 7.50, 1964, 108 pages.

This book is devoted to the reader who wishes to familiarize himself with the design and the mode and cycles of operation of lathes. The introductory part dealing with the turning process and the turning tool is followed by a detailed description of the design of the engine lathe and the turret lathe, the most widely used types of lathes, as well as of their units of construction and elements. The later part of the book offers a survey of the most important special designs and single purpose lathes. Besides a description of the various lathe types, hints as to their rational use as well as performance characteristics are also given.

4. **Metal Working.** H. Graff. *Asia Publishing House*, Bombay, Rs. 5.75, 1964, 124 pages.

This book explains checking and marking in metal working followed by cutting, starting from chisel work as the most elementary working method. Cutting by means of the drill and details of handling of a drilling machine are also included in this section. The chapter on 'forming' deals only with manual skills. A number of tables are included to bring out clearly the interrelations. The last chapter of the book is devoted to 'joining'. Screw connections and rivet joints which are generally used in practice, and the topic of soft soldering are dealt with in this section.

5. **Technical Drawing.** O. Schmidt. *Asia Publishing House*, Bombay, Rs. 8.50, 1964, 228 pages

This book deals with all theoretical problems and practical tasks involved in the work of the draftsmen. The grasping of the interrelations between constructional details, rather difficult for some part, is facilitated by inclusion in this book of numerous illustrations and practical examples. It is presumed that the reader will have some practical shop experience and fundamental knowledge of geometry. The book would prove useful to students of engineering and professional draftsmen.

6. **Non-Cutting Shaping.** F. Petrak. *Asia Publishing House*, Bombay, Rs. 10.00, 1964, 192 pages.

In this book, the most important processes of non-cutting shaping employed in the engineering industry are dealt with. Emphasis in the exposition is on modern manufacturing methods and their economical advantages, and hence the book is particularly suitable for technicians and engineers, especially those concerned with production engineering and manufacturing industry. The processes dealt with in this book are casting, forging, welding soldering and brazing, bonding of metals, power metallurgy and plastic deformation of metals.

OBITUARY

The sympathy of the Institution is extended to the relatives of those whose passing is recorded here.

Shri A. de Souza

Shri A. de Souza, B.A., B.E., A.M.I.C.E., A.M.I. Struct.E., M.I.E., died on March 11, 1965, at the age of 58.

Shri A. de Souza graduated from the Bombay University in 1926, and took his B.E. degree in Civil engineering from the College of Engineering, Poona, in 1929. He had his training in public health engineering in the Public Health Circle, Bombay, P.W.D., from 1930 to 1933. He was appointed Lecturer in Applied Mechanics in the College of Engineering, Poona, in 1935. He was a Professor in the Department of Aplied Mechanics, College of Engineering, Poona from 1945. In April 1957, he was appointed Principal, College of Engineering, Poona, and was transferred as Principal, Government Engineering College, Nagpur, in April 1958. He was responsible for the construction of a road test track and soil mechanics and concrete research laboratory for the Government of Bombay, and for a Test House for the Government of Bombay.

Shri A de Souza joined the Institution as Associate Member in 1947, and was transferred to Member in 1950. He was Chairman of the Nagpur Centre of the Institution in 1960-61.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organisations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situation Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

YOUNGMAN, 24, B.Sc., passed Section A of the Associate Membership Examination of the Institution of Engineers (India), having two years experience in earthwork, surveying, drawing, testing of materials, etc., seeks suitable employment or an apprenticeship in electrical, mechanical or any other concerns. (Office ref. E.S. 185)

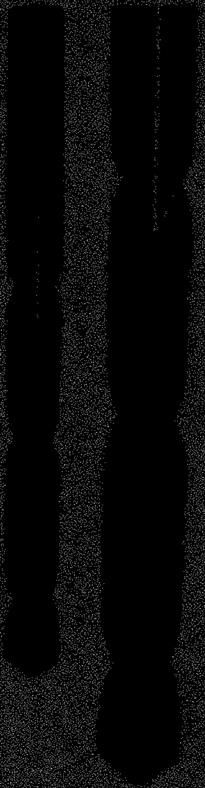
YOUNG ENGINEER, 26 years, passed Section A of the Associate Membership Examination of the Institution of Engineers (India), possessing first class diploma in electrical engineering having about 8 years experience in erection and maintenance of H.T. and L.T. lines and sub-stations A.C. and D.C. motors with ancillary equipments and other electronic equipments and a pack of welding sets. At present drawing Rs. 750, seeks a suitable change in a leading concern. (Office ref. E.S. 187)

DESIGN AND DEVELOPMENT ENGINEER, passed Sections A and B of the Associate Membership Examination of the Institution of Engineers (India), age 30 years, very hardworking and having more than 13 years experience in the design, development and manufacture of jigs, fixtures, press tools, special purpose machine tools and gauges, holding at present a very responsible position in a leading manufacturing concern, employing more than 3,000 persons, seeks a suitable change. (Office ref. E.S. 188)

YOUNG CIVIL ENGINEER, 25 years, passed Section A and B of the Associate Membership Examination of the Institution of Engineers (India), possessing also diploma in civil engineering, having five years experience in design execution and maintenance of buildings, roads, bridges, water supply and sanitary engineering works, seeks suitable change. Salary expected is Rs. 600. (Office ref. E.S. 189)

YOUNG ELECTRONICS AND TELECOMMUNICATION ENGINEER, age 30, B.Sc., passed Sections A and B of the Associate Membership Examination of the Institution of Engineers (India), having 5½ years experience in design, maintenance and handling of electronic equipments like, communication and commercial type receivers, 20 kW transmitters, high-fidelity amplifiers, tape-recorders, disc recorders, etc., seeks immediate change in suitable position in a leading organisation, preferably around Calcutta. At present drawing over Rs. 500 in an old reputed organization. (Office ref. E.S. 190)

A HIGH FIRST CLASS, aged 31, passed B Sc. Physics of Madras University, passed Sections A and B of the Associate Membership Examination of the Institution of Engineers (India) in electrical engineering subjects and a Graduate Member of the Institution, passed the City and Guilds of London Institute's examinations in Radio and Telecommunications Engineering and qualified for the Graduate Membership of the Institution of Telecommunication Engineers, five years experience in a leading telecommunication industry and three years experience in the teaching line in a polytechnic, fully conversant with other professional examinations, seeks a suitable change as Lecturer in a engineering college on a suitable starting salary or a responsible (whole time post) in Defence Technical Training institutions coaching for various professional examination or a suitable post such as service engineer in electronic engineering firm or suitable posts in industries for organizing coaching for professional examination. Employment in South India preferred. Salary expected Rs. 600-1,000. (Office ref. E.S. 191)



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The Council has directed that hereafter all payments to the Institution shall **only** be made :

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(2) in cash tendered at any branch in India of the State Bank of India along with bank-cards A & B;

(3) in cash, cheque or demand draft deposited at the cash counter of the office of the Institution Headquarters in Calcutta; and

(4) by postal order to a maximum of Rs. 10 for the cost of publications and Studentship application registration fees only.

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ADVERTISEMENTS IN THE INSTITUTION'S PUBLICATIONS

Members are well aware that the existing inflationary conditions compel the Institution to seek every possible means to supplement its income in order to combat the rising costs, so that the services to its members and the engineering profession as a whole will not only be maintained but expanded. Costs have particular validity when the Institution's publications are concerned, the scale and scope of which are unprecedented for any organisation in this country.

The Headquarters, therefore, consider it necessary to do all they rightfully can to increase the quantity of advertisements in the publications. A greater number of advertisement pages would be of real help in offsetting some of the expenses of the publications

It is stressed that the Journal in all its Parts, the Bulletin and the Year-Book have also a large circulation oversea and suitable advertisements in them can materially aid the present drive to the export more of India's engineering products. There is also great scope for advertisement of the products and equipment supplied by constructional, light engineering and ancillary industries, and for firms whose goods and services will appeal to members as individuals. The Headquarters believe that these publications are most attractive media for this type of advertisement and that many members connected with firms would be glad to use this means of publicizing their activities. Also, as increasing proportion of commercial and executive positions in industrial, contracting and public organisations become occupied by professional engineers, so do the publications reach more and more to those to whom engineering advertisements are directly useful.

Members whose positions enable them to help the Headquarters in this effort are requested to bring to the notice of publicity managers the merits of the Institution's publications as channels for reaching purchasers of engineering equipment. A brochure giving full particulars of rates and other information may be obtained from the Technical Officer (Scientific) at the Headquarters at 8 Gokhale Road, Calcutta 20.

SETTLEMENT OF ENGINEERING AND BUILDING DISPUTES BY ARBITRATION*

T. R. Mehandru
Member
Fellow, Institute of Arbitration (London), and Honorary Secretary,
Association of Consulting Engineers (India)

'The object of this talk, and the discussion that will follow, is not to blame or criticize any organization or individual, but to take stock of the present position and suggest such improvements as may be considered necessary. I therefore specially welcome constructive suggestions for improving this position.

For the successful completion of any contract, proper understanding, patience and cooperation on the part of all concerned are very necessary. Without these and the spirit of accommodation, no effective team work is possible and no tangible results can be expected. With the best of intentions, no matter how carefully the tender documents, comprising conditions of contract, detailed drawings, specifications and priced bill of quantities, are prepared, genuine differences and disputes generally do and can arise in regard to their intent and implication. These differences can be best settled through discussion in a spirit of give and take ; but when one party or the other adopts unreasonable, aggressive and stubborn attitude and the contractor is determined to vigorously press, at all stages, excessive and sometimes untenable and frivolous claims for additional payment, the position becomes very much aggravated. Frequently, completion of the work under such circumstances is very considerably delayed and several complications follow. Such differences, if personal discussions do not yield satisfactory result, can be settled through arbitration or litigation. The latter is generally a very laborious, troublesome and long drawn process and the ultimate result even then is uncertain. Relations between parties tend to get very strained and the position usually becomes very embarrassing for both the opposing parties. Arbitration, on the other hand, with even reasonable goodwill and restraint on both sides can be more private, and even otherwise less harmful and awkward. The parties to the dispute need not lose regard for each other and further business between them can continue fairly smoothly. During the past fifty years or so, this way of settling disputes has generally been recognized and preferred in all progressive countries of the world. During this period, the United Kingdom has specially established a very inspiring and enviable reputation for the integrity and impartiality of its professional arbitrators for arbitrations very creditably undertaken by them in the domestic and the international field.

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* Text of a talk delivered on March 5, 1965, at Delhi, arranged under the joint auspices of the Association of Consulting Engineers (India) and The Institution of Engineers (India.)

Suggestions and comments by members may be sent to the Union Minister of Works and Housing, Government of India, New Delhi.

In building and engineering contracts, there is usually a clause that any dispute between the employer and the contractor shall be settled through arbitration rather than by resort to litigation. In the case of works carried out in the public sector, a single arbitrator, generally a government officer, is appointed by the department. In the case of private works, the position varies. Usually, in the latter case, one arbitrator is appointed by the employer and one by the contractor, and the arbitrators so appointed have to agree upon an umpire acceptable to both of them. Sometimes, the stipulation is that the parties have to ask jointly an established professional institution to nominate a sole arbitrator, unless they independently agree upon one. The contract form of the Central P.W.D. in force at present provides 'Except where otherwise provided in the contract all questions and disputes relating to the meaning of the specifications, designs, drawings and instructions hereinbefore mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right matter or thing whatsoever, in any way arising, out of or relating to the contract, design, drawings, specifications, estimates, instructions orders or these conditions or otherwise concerning the works, or the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the sole arbitration of the person appointed by the additional Chief Engineer, Central Public Works Department, in charge of the work at the time of dispute or if there be no Additional Chief Engineer the administrative head of the said C.P.W.D. at the time of such appointment. It will be no objection to any such appointment that the arbitrator so appointed is a government servant, that he had to deal with the matters to which the contract relates, and that in the course of his duties as government servant he had expressed views on all or any of the matters in dispute or difference. The arbitrator unto whom the matter is originally referred being transferred, or vacating his office, or being unable to act for any reason, such additional chief engineer or administrative head as aforesaid at the time of such transfer; vacation of office or inability to act, shall appoint another person to act as arbitrator in accordance with the terms of the contract. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor. It is also a term of this contract that no person other than a person appointed by such Additional Chief Engineer, or administrative head of the C.P.W.D. as aforesaid, should act as arbitrator and, if for any reason that is not possible, the matter is not to be referred to arbitration at all.

Subject as aforesaid the provision of the Arbitration Act, 1940, or any statutory modification or re-enactment thereof and the rules made thereunder and for the time being in force, shall apply to the arbitration proceeding under this Clause. The position in other government departments like the Railways, the Military Engineers Service, etc. is more or less the same. That is, they also normally appoint departmental employees as arbitrators.

Litigation since the Second World War, and especially after the political partition or our country, has very greatly increased, in volume and extent, because of various development schemes taken up in the private and public sectors. Despite the increase in the number of new judges appointed and the new courts opened, there is a tremendous amount of work pending in various courts all over the country. More cases appear to be coming in than disposed of, and some of the pending cases have been going on for years. The right of appeal from decision of various courts to the higher courts leading up to the Supreme Court, make settlement of such disputes so expensive, time consuming and inconvenient and uncertain. Cases are known where such long drawn and costly litigation had even ruined altogether some parties and forced them to close down their business. Settlement of disputes through arbitration is therefore decidedly the best way, unless settlement by personal discussion is reached, as the arbitral procedure can be comparatively more speedy and less costly, if the contending parties so desire.

The Arbitration Act in force at present was enacted in 1940. It is generally based on the law of arbitration which applie in England. The latter was revised in 1950. Its further revision is under active consideration. Efforts are being made to make the same more helpful up-to-date and equitable.

For the success of the arbitral method of settling disputes, it is very desirable that the arbitrator should be a very conscientious person, willing to take up the responsibility of arbitration in an impartial manner without fear or favour. The arbitrator must make sure that his appointment is in order and valid. He must carefully satisfy himself about his jurisdiction and authority and make sure before sealing the award that the latter is enforceable. Failing that, the arbitral procedure, instead of saving time and avoiding reference to law court, may prove altogether a waste of time and money as one contending party or the other may on grounds of technical misconduct of the arbitrator move a court of law to have the award set aside. Such references to courts of law, even where not warranted, have been known to have been made, often, merely to mark time and cause nuisance.

I have endeavoured to collect statistics from various government departments about the number of cases disposed of during the last five years, and the number of those still pending disposal. I have not been successful up to now in getting this information. Perhaps, some of the gentlemen, belonging to such departments and present here, will be able to give some facts and figures. However, there is no doubt that the number of disputes referred to arbitration has greatly increased for various reasons. We must, therefore, try to find out why this is so. We should also do our best to ensure that wherever reference to arbitration is unavoidable, the award should be speedy, just and fair for the parties concerned.

Our building industry is not properly organized at present. The vast majority of contractors, suppliers, tradesmen and craftsmen do not take sufficient interest or pride in their creations or achievements. Quality of work is hardly their guiding motive. Their primary consideration and aim is maximum and earliest possible profit, somehow or anyhow. Frankly speaking, the government, and even the public, have not given the industry the necessary encouragement and support. Only recently some improvement has been noticeable. I hope the position will improve a great deal before long. If properly geared and encouraged, the building industry can very greatly accelerate all round national advancement on sounder and more satisfactorily lines. This industry can become one of the leading national industries as is actually the case in the United

Kingdom, the United States of America and other progressive countries. It must therefore be given every possible encouragement by the government, chambers of commerce, the industry and the public.

The contract form used by government and semi-government departments is not in keeping with the conditions prevailing in our country at present. The conditions of contract contained therein and generally adopted by them require urgent revision in several important respects. These conditions should be made more equitable and fair to the government as well as the contractor. If this is done, tenderers will, I am sure, quote lower rates and contracts would be completed more smoothly and quickly. The saving in cost may be as much as 10% on the expected outlay. The accurate amount of the latter is not definitely known yet. At a very conservative estimate, it may be Rs. 5,000 crores in the Fourth Plan, in the private sector. Thus, a saving of about Rs. 500 crores might well be made and can be provided for constructing more houses, hospitals, schools, roads, railway lines, air ports, and for arranging more water supply systems and other essential requirements, and better living conditions especially in rural areas and congested industrial centres.

The reason why so many cases are being referred to arbitration or the courts of law in my opinion, are :

(i) The tender documents, *i.e.*, conditions of contract, drawings, specifications and detailed estimates are not somehow, due to want of time or otherwise, made sufficiently comprehensive and clear. Before the agreement is signed, the deficiences and defects in these documents are not made good. During the course of execution of the works, omissions of certain items and discrepancies between the drawings and estimates or specifications, become apparent; the realization that the actual cost will be very much higher than the amount sanctioned on the basis of the detailed estimates, makes the position difficult, and often causes good deal of delay as rates of nontender and substituted items have to be discussed and agreed with the contractor. In order to keep the cost as low as possible and close to the sanctioned amount, in such cases, perforce, specifications have to be revised very considerably and a lower standard of quality has to be accepted. Unfortunately, such revisions are made rather late, with the result that the finish of the work cannot be as good as originally intended. In any case, tempers and mutual regard get considerably affected. Disputes and differences develope, in an atmosphere of fear and mistrust.

(ii) Generally without regard to the antecedents, capacity and reputation of the contractor, the work is assigned to him, because of normal government policy, even if his rates are found to be unworkable, because he has put in his tender without even properly studying the tender documents and ascertaining the site conditions. When work is in progress, the consequences of low tendering becomes clear. The contractor adopts delaying tactics and does his best to buy and use cheaper quality materials, and provide lower standard of work. He also persistently attempts under one plea or the other to have the specifications revised with the hope of creating non-tender items of work for which he usually demands excessive, at any rate, more favourable rates. If the engineer or architect in charge is experienced, alert and conscientious, he may not agree to such tactics and manœuvres. The attitude of one party or the other in such a situation becomes adamant, often aggressive, and different interpretations than those really justified are sought to be given. If the architect or engineer in charge is not sufficiently cautious and watchful, a very embarrassing position can arise. The cost swells up. Further disputes and difference develop and upset progress of work.

(iii) The audit and account procedures are very much out of date and cumbersome, involving great deal of wastage of time and unnecessary additional cost. The approach of these officers is not realistic and sufficiently human, but on the whole obstructive, mostly because they fail to appreciate the urgency of the work and the technical processes and limitations. They interpret the conditions of contract and the specifications in a very restricted and narrow sense. They invariably distrust both the contractor and the architect or engineer in charge of the work, and suspect their motives. The contractors get generally fed up and have sometimes no option but to ask for arbitration, especially when their money is locked up beyond expectation, and loss on the job issure.

(iv) Cases have been known where in spite of the very best intentions of the contractor and the engineer or architect in charge, these had to be referred to arbitration as on account of some deviations made in the specifications and the plans, reasonable and fair rates could not be agreed to by the engineer or the architect in charge, or additional reasonable claims for payments were not recommended for fear that audit objections will have to be faced at one stage or the other, and awkward explanations may have to be given. The general view of the supervising officers, in such cases, appeared to be that any additional payment or claim awarded by the arbitrator, or allowed by a court of law, could not be questioned by the auditors, or higher government authorities, and therefore arbitration was the best way out.

(v) Cases have also been known where the chief motive of the contractors was to create awkward situations for the supervisory staff and take undue advantage of their goodness, or inexperience or indifference. Because of their excessive greed, they had put in exhorbitant claims, which strictly speaking could not be considered permissible, and were accordingly not recommended by the supervisory officers for acceptance. The contractors had referred their claims to arbitration hoping to derive some benefit or possibly a better settlement of their claims by the department before the award was made.

(vi) Some cases were referred to and decided by arbitration, and even law courts, since one party or the other was somehow unduly aggressive and stubborn.

There are good and bad contractors everywhere. With goodwill, understanding and care on the part of both the parties primarily concerned, contracts can be smoothly and creditably, carried out without any reference to arbitration or law courts. In my 30 years professional work, both in Lahore and here in Delhi, you will perhaps be glad to know that none of my cases had ever come up before an arbitrator or a law court, for settlement. However, there can be very genuine difference of opinion on some issues. To reduce such differences to the very minimum, the following suggestions are made for the very serious and urgent consideration of all concerned. I had urged these a few days ago in the course of my detailed discussion with the Chairman and the members of the Study Team, which had been set up by the Union Ministry of Works and Housing for revising the current practices and procedures of the C.P.W.D. I await the report of that team in due course with great interest.

These suggestions are :

(i) The current accounting and audit procedures should be simplified. While keeping necessary checks and safeguards, the approach of accounts officers and auditors should be made more practical and human. They must adequately appreciate that their roll, as also that of the supervising architect or engineer, and the administrator, is to assist and encourage the contractors in every reasonable manner, within the terms and scope of the contract, to complete the same expeditiously, properly and economically in the national cause ;

(ii) The present form of contract generally used by government and semi-government departments, must be made more equitable and fair to all parties concerned and in keeping with the democratic national policy of our Union Government. Incentives for better performances should be offered. It will create greater confidence, and will be more in keeping with the spirit of our times. if the arbitrators instead of being Government or departmental employees are independent experts. They could be appointed by reference to and through the assistance of various professional bodies, as is generally done in the U.K., the U.S.A. and other advanced countries. When issues in disputes are essentially of engineering character, the Institution of Engineers (India) should be approached ; when architectural issues are involved, help of the Indian Institute of Architects should be sought. On the same basis, the assistance of the Association of Consulting Engineers (India), the Institute of Chartered Accountants, the Institution of Surveyors and the Bar Council of India should be sought for the appointment of arbitrators. Alternatively, each party to the dispute should be allowed to appoint an arbitrator, and the two arbitrators so appointed should agree upon an umpire, unless the contending parties mutually agree upon a sole arbitrator, who should usually be a specialist on the issues in dispute ;

(iii) Efforts should be made to revise the Arbitration Act currently in force in our country, to the extent necessary, in the light of present day conditions ;

(iv) The registration of contractors should be done much more carefully than hither to by a broad based standing committee, having as its members representatives of various government departments, the Builders Association of India, the Institution of Engineers (India), the Association of Consulting Engineers (India), the Indian Institute of Architects, the Institute of Chartered Accountants, the Bar Council of India, the Federation of Indian Chambers of Commerce, and other interests. In the case of those contractors already registered with various government deapartments, drastic action should be taken against those whose performance has been found unsatisfactory. Names of those found unworthy and unfit to the retained on the approved list should be deleted from the register, and such deletions be made public. Such an action will make others more careful and businesslike ;

(v) The Indian Builders or the Contractors Association should be strengthened, laying effective stress on national service and for building up good name and high traditions for their profession, in their own interest. They could further develop and energize their central and regional organizations ;

(vi) The present practice of assigning the work to the lowest tenderers without due regard to their previous performance, reputation and capacity should be given up. Selective tendering should be encouraged and accepted as a policy. This course, I am confident, will ensure quicker, better, smoother and more economical execution of works. It will also ensure better working conditions ;

(vii) The architect or the engineer in charge of the scheme should be given greater powers, so that once the scheme has been duly sanctioned he should be able to push on with it speedily, within the scope already approved, subject of course to necessary but practical safeguards. They must be relieved of useless correspondence and routine work so that they can devote more attention to technical work, and thereby produce better results ; and

(viii) The architects and engineers should be given adequate time and fullest possible details of present and future requirements, for the preparation of the drawings, estimates and tender documents. They should not be unduly rushed otherwise there may be good deal of wastage of time, public funds, and energy. There may also be very embarrassing claims for extra payment to contractors, and great deal of increase in cost, resulting possibly in avoidable misunderstandings and misgivings.

The cost of arbitration even at present to the country, in terms of money, time and energy, is undoubtedly very considerable. It may increase in volume and extent if current trends are not properly checked. May I therefore very earnestly appeal to all the parties concerned with the planning and execution of engineering and building works to face the situation boldly. We must place the national interests of the country first and should help to build good traditions and sound conventions with sympathy and understanding, and thereby help to reduce arbitration work and litigation as much as possible.

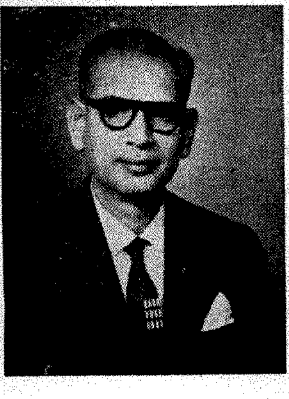
I thank you once again and request you to offer your constructive suggestions'.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Andhra Pradesh Centre

Chairman's address by Shri V. Parvathesam, B.E., M.I.E., at the 27th Annual General Meeting of the Centre on December 22, 1964

After welcoming the Chief Guest, Dr. Hussain Zaheer, Director-General, Council of Scientific and Industrial Research and other invitees, Shri V. Parvathesam thanked the Committee of the Centre for electing him Chairman for 1964-65.



Delivering the Chairman's Address, he said, 'I propose to deal primarily with the power development in Andhra Pradesh in my address this morning.

The State of Andhra Pradesh has a unique combination of 3 million kW of hydro-electric power potential, and 4,000 million tons of coal reserves for thermal generation. The State has two mighty rivers and large areas rich in collieries. The oldest thermal station in the State which was commissioned in 1923 is at Hyderabad on the Hussain Sagar Lake. In the Telangana region, the development of power was confined mostly to the metropolitan cities, till the formation of Andhra Pradesh. In the Andhra region, power development in the late twenties took place on a limited scale through privately owned companies. The State undertook bulk generation of power under its management only in 1938 with the commissioning of the Visakhapatnam and Vijayawada thermal stations.

Real power development in the Andhra region may be said to have commenced with the advent of the Machkund hydro-electric scheme after the formation of the State. The first unit of the Machkund hydro-electric station was commissioned in August 1955 and the Tungabhadra hydro-electric station early in 1957, thus bringing the entire area under one supply zone from hydro resources. In the Telengana region, the Nizamsagar hydro-electric station was commissioned in 1956, followed by the Ramagundam thermal station in 1957. Andhra Pradesh has at present thermal stations, at Hussain Sagar, Vijayawada, Visakhapatnam, Ramagundam, etc., and gas turbo sets at Erragudda and four hydro stations, *viz.*, Machkund, Tungabhadra, Humpi and Nizamsagar. All the stations are interconnected through statewide 132 kV transmission lines extending from Machkund in the north-east to Tungabhadra in the south-west. The Telengana region is also connected between Ramagundam, Nizamsagar and Hussain Sagar and in turn, it is interconnected to the Andhra region through a 132 kV line from Tadepalli to Hyderabad.

Before the Machkund hydro-electric scheme came into operation in 1955, electric power was obtained in the Andhra area through costly but small thermal power stations located at Visakhapatnam, Vijayawada and Nellore, serving loads within a radius of 50 miles. The thermal station at Hussain Sagar catered for the needs of the twin cities of Hyderabad and Secunderabad. At a few other places, small diesel stations were also started to effect the supply. Power supply at the beginning of the First Five Year Plan was meagre. Power development in the State got a fillip with the commissioning of the Machkund and Tungabhadra hydro stations in the Andhra area and the Nizamsagar hydro-electric scheme and the Ramagundam thermal scheme in the Telengana region during the First Five Year Plan. The installed generating capacity in Andhra Pradesh was 59,900 kW at the time of its formation. This capacity steadily rose to 213 MW in 1958 and has not risen higher, since a few planned power projects could not be commissioned in time due to difficulty in the release of foreign exchange, etc. Only this year a small addition to the installed capacity has been made by the commissioning of two gas-turbo sets at Hyderabad (total installed capacity 20 MW) and four generating units at Tungabhadra (Andhra share of installed capacity is 28.8 MW). As no substantial generation could be added to the grid since 1958, the Electricity Board had to resort to rationing of power to the consumers. Some of the new consumers had also to be supplied construction power to enable them to proceed with their industrial undertakings. The Board has thus taken care not to deny supply to any prospective consumer, and is alive to the need for a rapid growth of load, to use up whatever generating capacity is made available in the near future. The maximum demand on the system has steadily risen through the operation of a grid prudentially utilizing the available installed capacity, and has touched a figure 204 MW during the year, while at the time of formation of Andhra Pradesh, the total maximum demand was only about 54 MW.

There has been persistent demand in the State for the suppply of electricity to villages for agricultural pumps, rural industries, etc. The total number of villages electrified by the end of March 1964 was 4,642 as against 212 villages electrified at the beginning of the First Five Year Plan. Thus, against a total of 29,220 towns and villages Andhra Pradesh, the villages so far electrified represent about 16% only.

It is programmed to electrify at least 10,000 additional villages during the Fourth Plan period. This will naturally stimulate village economy by facilitating establishment of cottage and rural industries, and what is more important, it will provide supply to agricultural pumps which could increase food production. As against an expected supply to about 30,000 agricultural pump sets in the State at the end of the Third Plan, it is proposed to extend supply to 120,000 more pump sets during the Fourth Plan period. These pump sets can irrigate about 5 lakh acres and will result in 2.50 lakh tons of additional food production. The gross revenue which was only Rs. 70 lakhs during the First Five Year Plan has risen to nearly 1,150 lakhs during the current year and is expected go up to 1,300 lakhs by the end of Third Plan. The total number of consumers has increased to 406,000 during the current year as against 30,300 at the beginning of First Five Year Plan. The per capita consumption which was only 2.5 at the beginning of the First Five Year Plan has risen to nearly 22 during the current year. It may be stated here that the per capita consumption is low compared with the all-India average of 38. Even at the end of the Third Plan, the per capita consumption is expected to be only 30 units as against 80 units for the entire country.

The progress made from the beginning of the First Five Year Plan, and especially after the formation of Andhra Pradesh, is substantial when compared with the previous years, but still the State has to make further strides in the development of power and its distribution in order to level up with other states. The State is already endowed with abundant natural resources for the development of hydro power as well as thermal power, and has a high potential demand in view of the existence of extensive mineral resources and the consequent scope for industrial development. The main bottleneck is the lack of adequate funds for executing the several projects in the State. An outline of the major projects now under execution is given below

1. *Upper Sileru hydro-electric scheme*

This utilizes the tail waters of Machkund and is situated 50 miles lower down the same river. The power benefits from the Project could be utilized fully and quickly in a short period due to the existence of the power grid for a major portion of Andhra Pradesh. This brings in an additional installed capacity of 120 MW and at least 60 MW of this is likely to be commissioned by the end of the Third Plan.

2. *Lower Sileru hydro-electric scheme*

This scheme has a potential of 600 MW, of which 300 MW is proposed to be developed in the first stage. The project uses the regulated tail waters of the Upper Sileru hydro-electric scheme and is situated a few miles below Upper Sileru. The three units are expected to be commissioned by the middle of the Fourth Plan.

3. *Kothagundem thermal scheme—first stage*

This is a pit-head station situated near the collieries and utilizes the available low grade coal. It brings in an additional capacity of 120 MW during the second stage. The first stage is expected to be completed in the Third Plan to the extent of at least 60 MW and the second stage early in the Fourth Plan. Financial aid from the World Bank has been made available to this project.

4. *Ramagundam thermal scheme*

A 62.5 MW generating set is being installed under A.I.D. assistance, and is expected to be commissioned in 1966-67. A 200 MW station is proposed to be installed as a second stage with the assistance of the industrial scientist Dr. Dharma Teja, on 'Pay as you earn' basis. This station is likely to come on to the grid by January 1968.

5. *Nellore thermal scheme*

This is in an advanced stage of construction and is expected to bring in an additional capacity of 30 MW by the first quarter of 1965.

6. *Srisailam hydro-electric scheme*

This is a large hydro scheme with a total installed capacity of 770 MW and utilizes the waters of the Krishna. The civil works of the scheme have just been taken up, Kothagudem provides an excellent site for a superthermal station, since there are extensive coal deposits in and around, no doubt of low grade, which can be mined and utilized for economic power generation. Apart from the scheme for the installation of a 120 MW capacity at Kothagudem in the first stage and another of 120 MW in the second stage, it is proposed to instal further four units of 120 MW each in the Fourth Plan to cope with the demand' It is proposed to develop both the Kothagudem and Ramagundam superthermal stations, each with an installed capacity of 1,000 MW. The Srisailam hydro-electric scheme with an installed capacity of 770 MW and the Upper Sileru and Lower Sileru stations will all be interconnected through 220 kV transmission lines. A 220 kV line is also projected from Srisailam to Cuddapah forming an inter-State link interconnecting Singarapet in Madras State.

A nuclear station is also being thought of in the Fifth Five Year Plan, keeping in view the long range future load demands in the State. It will the have adequate thermal and atomic stations as base load stations and hydro stations as peak load stations. It will not be out of place to mention that the committees set up by the Government of India have indicated that Srisailam is one of the suitable sites for locating an atomic power station.

In order to interconnect power generating stations and facilitate grid operation, a large network of 132 and 220 kV transmission lines is under execution.

Completion of the transmission system planned for the Third Five Year Plan will not be adequate though it is likely to cost as much as Rs. 20 to 25 crores. It is necessary to suitably strengthen the transmission system, to enable transmission of 1,300 MW to load centres within the States and also for the exchange of power to the extent necessary. In the Fourth Five Year Plan, 1,083 km of 220 kV double-circuit lines and 561 km of 220 kV single-circuit lines and 845 km of 132 kV single-circuit lines besides a large network of 33 kV and 11 kV lines are proposed. A large number of bulk industrial loads in the State are proposed to be supplied through the above network. A central load despatching station is also proposed for the control and operation of the entire grid, and strengthening of the carrier current communication and protection systems have also been proposed. The additions to installed capacity during the Third and Fourth Five Year Plans are :

Third Plan		MW
Upper Sileru hydro-electric scheme	..	60.0
Kothagudem thermal scheme—first stage	..	28.8
Tungabhadra hydro electric scheme—second stage	..	28.8
Nellore hydro electric scheme	..	30.0
Gas-turbo sets at Hyderabad	..	20.0
Total addition during the Plan	..	198.8
Capacity at the beginning of Plan	..	213.0
Total by the end of the Plan	..	411.8

Fourth Plan		MW
Kothagudem thermal scheme—first Stage	..	60.0
Upper Sileru hydro-electric scheme—first stage	..	60.0
Kothagudem thermal scheme—second stage	..	120.0
Kothagudem thermal scheme—third stage	..	480.0
Lower Sileru hydrc-electric scheme	..	300.0
Srisailam hydro-electric scheme	..	110.0
Ramagundam thermal scheme—second stage	..	62.5
Ramagundam thermal scheme—third stage	..	200.0
Total additional installed capacity during Plan	..	1,392.5
Total addition by beginning of Plan	..	411.8
Total installed capacity expected by the end of the Plan	..	1,804.3

In view of the demand always exceeding the installed capacity, advance action is proposed on the Kothagudem (second stage) and the Lower Sileru schemes during the Third Five Year Plan. The above programme covers the requirements of the State on the basis of a conservative forecast.

Andhra Prdesh has been one of the first few States to adopt uniform rates instead of a multiplicity of tariffs. The tariffs in the Andhra and Telangana areas have also been merged, and a uniform tariff structure has been evolved for adoption throughout Andhra Pradesh effective 1st April, 1963. The rates offered in the State for bulk industries are not burdensome ; agricultural and small industrial consumers are given specially low tariffs. The State Electricity Board has also developed a Stores and Transport Organization and Workshops to handle fabrication of line materials and also a training programme at technical training centres for lower grade employees. Besides, fecilities to obtain training abroad is given to engineers.

One of the problems facing the successful and speedy implementation of power projects is the paucity of graduate engineers. Graduate engineers are recruited as Junior Engineers on a salary of Rs. 250 basic, and it takes nearly 5 years for them to get a promotion to the next cadre of Assistant Engineers. Private enterprises offer better terms to young engineers, with the result that the Government is unable to attract, much less retain, them in important nation building projects. Even the few engineers who join the departments leave it abruptly even within the first year of joining. It is time that the authorities consider this problem seriously and evolve a realistic plan by which reasonable terms of service are offered to bright and enthusiastic graduate engineers. A suggestion that commends itself is that they may be recruited directly as Assistant Engineers, and kept on probation for a period of one year, and subject to a written and *viva voce* examination at the end of the year for final selection. Expeditious formulation of the Indian Service of Engineers, to eliminate disparities in the pay structures that now exist between one State and another, is another point requiring urgent consideration.

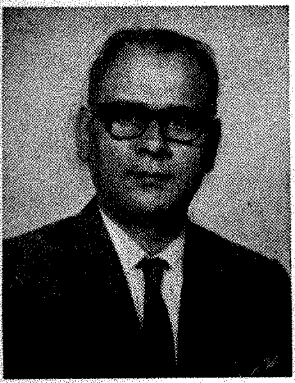
Andhra Pradesh has a broad based plan for intensive power development. It hopes to wipe out the power deficit by the end of the Fourth Plan and connect itself as a member-State of the Southern Region and derive consequential benefits. Due emphasis on industrialization has been envisaged. Reasonable rates for bulk industries to be set up within the State have also been kept in view.

If we, the engineers of Andhra Pradesh. falter in taking up the challenge that we are facing, we all shall be eventually answerable.'

Bengal Centre

Chairman's address by Shri S. K. Majumder, B.E., M.R.S.H., M.I.E., at the 44th Annual General Meeting of the Centre on December 26, 1964

After welcoming the Chief Guest, Shri S. K. Mukherjee, Minister of Finance, West Bengal, and other inivitiees, Shri S. K. Majumder thanked the Committee of the Centre for electing him Chairman for 1964-65.



Delivering the Chairman's Address, he said, I feel that the role of public health engineering is vital for the progress of a country. I shall try to say some thing about the achievement in respect of water supply and improvement of environmental sanitation in our country, particularly in the State of West Bengal.

Soon after independence, the government realised that very little word had been done in the past with regard to water supply and sanitation, specially in rural areas where people used to drink water from tanks and shallow and insanitary wells. A nationwide programme for water supply and sanitation was launched and this was further augmented with the advent of the Five Year Plans. The achievements so far, though quite appreciable, cannot be termed as 'satisfactory'. Unlike other engineering projects, water supply and sewerage schemes relating to towns have to be taken up with the concurrence of the municipalities concerned after being satisfied that the local body is financially equipped to repay the loan advanced by the government for financing the project. In reality, provision of water supply and sanitation facilities in a town is the prime responsibility of the municipality concerned. Unless some subsidy is given for the implementation of water supply and sanitation projects, the environmental condition of growing towns can never improve. At present, for implementation of such schemes, two-thirds of the estimated amount is advanced by the government as grant, while the balance is also advanced as loan by the government to be repaid by the municipality in 30 years with interest. With this impetus, the programme has advanced quite well though the progress was much hampered due to the procedural stages the schemes had to pass through. There are two corporations and 87 municipalities in the State of West Bengal. In 1947, two corporations and 28 municipalities were provided with water supply; of these, many were inadequate, specially in towns which had undergone considerable development. Since then, it has been possible to construct 38 water works, of which 23 relate to augmentation of the existing water supply and 14 are in progress, while it has been possible to introduce sewerage system in one town only. It is rather distressing to note that even in the present age there are in our State 30 municipalities without any water supply. It is heartening to note that the government has taken a serious note of the problem and an amount of Rs. 340 crores is likely to be earmarked for national water supply and sanitation programmes in the Fourth Plan. It is expected that during the Fourth Plan it will be possible to introduce piped water supply in the remaining municipalities in the State. The question of sewerage however posses a very difficult problem. On the one hand, the municipalities are very reluctant to agree to bear any cost towards implementation of the sewerage schemes, obviously for the reason that not much return is expected of it in the form of taxes, ; on the other hand, the cost of a sewerage scheme happens to be 4 to 5 times the cost of a water supply scheme for the same community. The execution of more and more water supply projects is aggravating the problem of drainage in towns. In consideration of all these factors, the Government of India is now contemplating to subsidise sewerage schemes to the extent of 50%. It is hoped that with this encouragement it will be possible to take up more sewerage schemes during the Fourth Plan. Speaking of the State of West Bengal, it has been estimated that an amount of Rs. 3 crores will be required to introduce piped water supply in the remaining towns, while approximately Rs. 60 crores will be required for the introduction of sewerage schemes in the municipal towns, leaving aside the city of Calcutta. Water supply and sewerage systems are absolute necessities for developing towns and more funds require to be diverted towards this objective, to help a decent and healthy living, free from epidemics and diseases.

The rural picture of the country is still worse. There was no municipality to look after the welfare of the public. The District Boards, out of their slender resources, sometimes sank a few tubewells or wells, the number of which was far below the minimum conceiveable requirement. Consequently, the villagers used water form tanks and insanitary wells for all purposes including drinking and often fell victims to various waterborne diseases. Before independnce, there were only 43,000 water sources in the rural areas of Bengal (*viz.*, tubewells and wells) which could be considered more or less safe. Tubewells being considered as protected water supply, the government took up a comprehensive programme of sinking deep tubewells in the rural areas according to an accepted target. Until now, it has been possible to sink as many as 60,000 sources. of which 48,000 happen to be tubewells and the remaining are wells. In fact, we would have preferred to sink tubewells in all the areas but for the fact that in some of the districts, due to the rocky nature of the soil. it has not been possible to penetrate beyond a depth of 50 or 60 ft. with ordinary tools and appliances. In such areas, sanitary wells have been provided. At present, there is a protected source of water supply within the reasonable reach of every villager in the State excepting in a few pockets where tubewells or wells could not be sunk due to natural causes. Our present target is to provide one source of protected water supply for 400 persons, with a minimum of one source per village. It is expected to reach this target in the course of the Fourth Plan. The beneficial effect of providing protected water source in rural areas is well manifested by the eradication of waterborne diseases like cholera, typhoid, gastro-intestinal disease, etc. which took a heavy toll of life in the past. Sporadic cases of cholera are even now occasionally reported from a few localities but the cause has been found to be elsewhere. Prima facie the problem of water supply in rural areas seems to have been solved. It has however been difficulty to keep all the tubewells in working condition in spite of organised maintenance squads provided in each thana. Further, these 1½ diameter tubewells do not last long, the average life being 5 to 8 years So it has been decided to change over to piped water supply systems in rural areas and a considerable amount has been kept apart in the Fourth Plan for this purpose.

There are however some problem areas in the rural sector of the State, mostly in the proximity of the sea (*e.g.*, Sundarbans and Contai). In these areas, tubewells have proved a failure, yielding saline water. Schemes are being prepared for piped water supply schemes in these areas. In some places, people have no choice but to consume saline water, while in some others, they have store rain water to meet their drinking water needs. It has been proposed to sink large diameter tubewells beyond the fringes of the salinity zone and convey the water by means of pipes. The Government of India has assured subsidy towards execution of these projects and it is expected that several such schemes will be taken up very shortly.

In the coal mining regions of Raniganj and Asansol, most of the wells dry up during summer and water is literally sold by the bucket. It is distressing that coal miners who risk their lives for the service of the country are deprived of this bare necessity of life. A comprehensive water supply scheme for this entire area was drawn up by the Directorate of Public Health Engineering at an estimated cost of Rs. 5 crores in 1957, with the Maithon reservoir as the source of supply. The scheme was delayed so long due to difference of opinion with the Centre on technical points. Decision has now been arrived at and in all probability. the scheme is likely to be taken up during 1965-66.

I wish to mention at this stage the good work that is being done by CMPO. We all know how the environmental sanitation of the city of Calcutta has deteriorated. Water works for the city of Calcutta, originally designed for a population of 1 million people some 100 years ago, has now to cope with a population of 3 or 4 million people. The same is true of the sewerage system. So long, it has been possible somehow to meet the situation by additions and alterations here and there but these two services are now in such a dilapidated and inadequate condition that nothing less than a thorough realignment of the entire system based on rational design can solve the problem. Besides these two major problems, other subjects such as slums, traffic congestion, etc. have made the situation grave Further, the impact of the suburban areas on the city has increased enormously and a simultaneous improvement of the suburban areas has also become imperative. The CMPO has been formed to plan an integrated overall improvement of the environmental condition of this entire area, called 'metropolitan district' comprising 33 municipalities and 37 non-municipal townships covering an area of 400 sq. miles and a population of 6 million. Calcutta has often been blamed to be one of the principal focii for the spread of cholera in Asia. National and international organisations devoted to human welfare are also keen on eradicating this dreadful disease. Through the assistance of the Ford Foundation and WHO. it has been possible to get the services of international engineers to find a solution to this grave problem. With the help of a team of expert sanitary engineers of our country, they are working hard to prepare a master plan which can be implemented in a phased way. They have progressed considrably and we expect to get a picture of the master plan shortly. In the meantime, efforts are being made to form the metropolitan district with an administrative organisation equipped with statutory powers.

A survey carried out by WHO in 1959 of 75 countries in the world with a population of 320 millions have revealed several interesting facts. Of the present urban population in these countries, 33% have piped water supply and another 26% have access to public outlets within a reasonable distance. This means that 130 million of the present urban residents depend for their water on wells, tanks and other sources which are generally open to contamination. This is an alarming picture in this age of science.

Nevertheless our achievements in the Third Plan have been encouraging. We have to remember that there is a large backlog to be cleared, since, before independence, very little work was done. Let us hope that the trend will be forward so that in the near future we are at par, if not ahead, of the other developed countries.'

Summaries of Papers Published in the Jounnal, vol. 45, no. 9, CI 5, ME 5 and ET 3, May, 1965

CIVIL ENGINEERING DIVISION

Mutual Interaction of Orifices in a Conduit

A. K. Biswas

Non-member

Fluid flow through a perforated conduit is usually analyzed assuming a single branch point and uniform flow over a considerable distance on either side of the junction. In such an analysis, the interference with fluid flow caused by mutual interactions of the successive orifices in a conduit is neglected. The paper presents a study on fluid flow through a perforated conduit considering the mutual interactions of orifices. Experimental verification of the theoretical results are also given.

Resistance to Flow in Alluvial Streams

R. J. Garde

Non-member

and

K. G. Ranga Raju

Non-member

In this paper, a method of computing the mean velocity in an alluvial stream is presented. Based on the data collected by the authors, several curves are drawn which can be used to obtain the stage discharge curve for alluvial streams.

Effect of Cement Quality on Coarse Aggregate Requirement in Cement-Concrete Mix

G. G. Kelkar

Student

During a cement-concrete road construction at Nagpur, it was observed that for the same volume of laid concrete, the consumption of coarse aggregate and hence of cement varied as cements obtained from different manufacturers were used. This paper describes the investigations which were undertaken to ascertain the genuineness of such variations in the consumption of cement and coarse aggregate and discusses the possible reason for the same.

Design of Hydraulic Spiral Case

G. Krishnaswamy

Non-member

This paper presents a method for the design of a spiral casing in a low head water turbine plant; it also points that it can be used without much error for designing the spiral casing in medium head plants also. A uniformly distributed flow in the turbine is assumed and the effect of friction is neglected. For a given vortex of constant moment of momentum, the relationship between the angle measured counterclockwise from the nose and the external radius R of the spiral casing at that section is obtained. The paper also gives an idea of the total width of a spiral casing at any section.

Design of Panset Dam Spillway Based on Hydrology of Catchment Region

G. G. Kulkarni

Associate Member

The design of a dam spillway is based on the maximum flood discharge expected to flow over it. Estimation of the maximum flood discharge is made by the unit hydrograph method if hydrological data for the river valley are known for a number of years; otherwise, empirical formulae have to be used to determine the same. This paper presents an analysis of the design of Panset dam spillway on the basis of actual hydrological data, which may guide the finalization of their designs during the reconstruction of the Panset dam.

Coefficient of Discharge of an Oblique Terminal Weir

P. K. Mohapatra

Associate Member

This paper presents a method for determining the coefficient of discharge of a rectangular, thin plated, oblique terminal weir. The discharge characteristics of an oblique weir as given by Istomina are compared with those of a normal terminal weir as given by Rouse and Kandaswamy. The effects of fluid properties on the discharge characteristics are also discussed.

Coefficient of Discharge of a Broad Crested Weir with control Gate

H. R. Pramanik
Non-member
and
S. K. Das Kaviraj
Student

A broad crested weir with a control gate is used for the regulatio of water flow in an irrigation system. Discharge with the gate fully open is obtained by certain empirical relationships ; but when the flow is obstructed by the gate, the relationship becomes complicated. For a correct estimation of the discharge in such gated flow, experimental determination of the characteristics of each section of the weir with reference to the upstream and downstream water levels and the shape of the gate is necessary. This paper presents a theoretical analysis of the discharge over a broad crested weir under gated conditions, based on experiments conducted in the River Research Institute, West Bengal, on the section of the Tilpara Barrage which has been built for the Mayurakshi project.

Analysis of Folded Plates by the Method of Additional Ridge Loads

N. Shanmughasundaram
Associate Member

In this paper, a method of analyzing folded plates by introducing additional unknown ridge loads caused due to joint displacements is presented. The procedure is developed on the lines of the existing relaxation methods and illustrated by two examples.

Energy Dissipation in Submerged Axially Symmetric Jet

N. S. Shasidhara
Non-member
and
Prof. K. Seetharamiah
Member

This paper presents a study of the energy dissipation in a submerged high velocity water jet under different flow conditions obtained by varying the velocity of efflux and the height of water in a stilling basin. In all the cases, there is a critical distance from the jet mouth within which energy dissipation is maximum ; beyond this, the energy of the jet is very small. It is found that the velocity of efflux does not have appreciable effect upon the energy dissipation characteristics. Also, it is seen that the lesser the submergence, the greater is the energy dissipation. The study presented in this paper may be useful for the design of the stilling basin under a hydraulic structure.

Pneumatic Sinking of Well in North Koel Bridge Foundation

V. Singh
Non-member

This paper describes the plants used for pneumatic sinking of wells for bridge foundation in the North Koel River. The working of the pneumatic plants under the various site conditions are also described.

Computation of Curvature and Deflection of R.C.C. Beams and Columns

N. S. Sinha
Associate Member
and
V. S. Rane
Non-member

In this paper, a procedure for computing the short time curvature and deflection of R.C.C. beams and columns due to loads applied continuously to failure is given. The period of application of the loads vary from a few minutes to several hours. The method for determining the moment *vs.* curvature values over a portion of a beam and a column is described and recommendations are given.

Studies on Design of Revised Profile for Bhakra Dam Spillway

Dr. H. L. Uppal
Member
T. D. Gulati
Non-member
and
B. D. Sharma
Non-member

The crest of the Bhakra dam spillway was originally designed at EL. 1645 for a maximum reservoir elevation of EL. 1685. In 1959, it was decided to raise the maximum reservoir level to E.L. 1690. Studies were conducted on two models of the spillway on different scales with the reservoir level at EL. 1690 to examine the pressure distribution, water surface profile, total overflow discharge, and conditions of flow in the stilling basin, and a comparison was made with the corresponding data of the original design. It was seen that a rise of 5 ft. in the maximum reservoir level resulted in an increase of discharge intensity at the crest from 1,000 to 1,170 cusec. per ft. and of the coefficient of discharge under un-gated conditions from 3.98 to 4.17 ; turbulence in the stilling basin also increased considerably. The details of the model studies and the experimental results are given in this paper.

CONCRETE CONSTRUCTION GROUP

Carryover and Stiffness Factors of a Two-Way Slab

Dr. P. Dayaratnam

Non-member

This paper presents the calculation of the carryover and stiffness factors for various values of the aspect and flexural stiffness ratios of a two-way slab considered as an orthotropic plate. The use of the carryover and stiffness factors is also explained by an illustrative example.

Approximate Solution of Simply Supported Rectangular Plate of Varying Thickness

P. Desayi

Associate Member

Using Galerkin's method, approximate solutions have been found for simply supported rectangular plates of: (i) constant thickness subject to uniform load, (ii) flexural rigidity varying linearly along y-axis and subject to a uniform load, (iii) flexural rigidity varying linearly along y-axis and subject to a distributed load which also varies similarly, (iv) flexural rigidity varying exponentially along y-axis and subject a uniform load, and (v) thickness varying linearly along y-axis and subject to a uniform load. It is interesting to note that the solution so obtained exactly coincides with the Navier solution for case (i) and has an error within 10% for case (iii) for which an exact solution is also available. The errors in the other cases are expected to be of the same order.

Plastic Design of Reinforced Concrete Slabs

Dr. R. Narayanswamy

Associate Member

Elastic design of a two-way reinforced R.C.C. slab does not consider the redistribution of moments which takes place after steel yields under tension. The ultimate design approach is more realistic and represents a more correct behaviour of the reinforced concrete in near-failure conditions. In this paper, the basic principles of the yield line method of limit analysis of reinforced concrete slabs are described and equations derived for analytical solution of the problem.

ROADS AND ROAD TRANSPORTATION GROUP

Contact Stress Between Bullock Cart Tyre and Road Surface

Y. C. Gokhale

Non-member

and

R. S. Mehta

Student

This paper describes a method for the determination of the magnitude and distribution of normal stress within the contact area of a bullock cart tyre. Contact stresses in bullock cart tyres made of iron as well as of rubber have been determined under different road surface conditions.

Planning of Highway System in Assam

G. C. Sharma

Member

This paper stresses the need for highway planning in general and describes the evolution of various patterns of highway system such as grid and star pattern, modified grid-star system, web and lattice pattern, crystal pattern, etc. in India. The deficiency of the existing highways in Assam is mentioned and the classification of highway system for future planning indicated in the paper. The hexogonal grid system of highway is suggested for Assam which satisfies most of the criteria specified in the Twenty Years Road Development Plan for India (1961-81).

MECHANICAL ENGINEERING DIVISION

Design of Eccentrically Loaded Bolted Joints

Dr. A. Bhattacharyya

Associate Member

and

A. Ghosh

Non-member

In this paper, the limitations of the classical method for designing a bolted joint under eccentric load are analyzed and a new method of design is presented considering the actual conditions of loading which exist in such a joint.

Relationship between Rolling Resistance and Diameter of Roller

H. R. Chaudhry

Non-member

The assumption that rolling resistance is inversely proportional to the diameter of a roller is not supported by any mathematical theory. In this paper, it is established by mathematical analysis and experimental verification that rolling resistance is independent of the diameter of a roller.

Analysis of Stagnant Phenomenon in Metal Cutting by High Speed Drop-Tool Trigger Mechanism

S. S. Das

Non-member

and

Dr. A. Bhattacharyya

Associate Member

The stagnant zone plays an important role in the mechanics of chip formation of single-point cutting tools. This paper presents a theoretical analysis of the extent and behaviour of a stagnant zone. A comparison of the theoretical and experimental results obtained with a high speed drop-tool trigger mechanism is also given.

Strength of Square Key for Fastening Hub to Shaft

S. Dayal
Non-member
and
D. P. Garg
Non-member

This paper presents an account of the experimental investigation on the strength of a square key used for fastening the hub to a shaft. For a given shaft size, an optimum size of the key is established and the effect of any clearance in the key way on the strength of the key is evaluated. The effect of shaft size on the strength of a square key is also determined.

Vibration of Beams with Variable Stiffness

Dr. P. Dayaratnam
Non-member

This paper analyzes vibration of beams with variable stiffness by iteration method. The differential equation of motion is expressed as finite difference equations which are then represented by a matrix equation of the form of a standard eigenvalue problem and the eigenvalues obtained through successive iterations. An example is worked out and the result compared with the exact solution. The error in the result of the problem is found to be 2.36% which is on the safe side. A number of examples of built-up beams are worked out and a comparison of the strength of beams of various shapes is presented.

Observations on Fixed Roots of Chips During High Speed Machining

G. R. Ponkshe
Non-member

Chip-tool contact during metal cutting process comprises a continuous contact, known as 'plastic contact', between the lower layers of the chip and the rake surface of the tool, and contact between the micro irregularities of the bottom layer of the chip and those of the tool surface. Abuladze has given a formula for calculating the length of plastic contact based on experimental results. In this paper, Abuladze's formula is verified from observations made on chip roots obtained with the help of a drop-tool mechanism and theoretical analysis of the same is given.

Some Experiments in Milling

V. Radhakrishnan
Non-member
and
S. K. Basu
Associate Member

Applying Buckingham's method of dimensional analysis and using experimental results, a formula for accurate determination of the forces and power required in a milling operation is presented in this paper. It is also shown that the basic mechanics of metal cutting is the same for turning, drilling or milling operation. Two nomograms for determining the forces and the specific pressure in a milling operation are given ; and the power consumed in milling can also be obtained from the nomograms if the cutting parameters are known. Graphs are plotted to show the permissible deflection depending on the resultant load on the milling cutter for two different column sections of a cantilever type horizontal milling machine.

INDUSTRIAL ENGINEERING GROUP

High Intensity Industrial Noises

S. K. Asthana
Non-member
and
V. Narasimhan
Non-member

A study of the noises prevailing in five large steel plants of India is presented in this paper. Noises are analyzed to find the octave band levels for estimating the hearing damage risk. Loudness levels of these noises are also calculated. From the measured peak sound pressure levels of impact noises, an estimate of the radiated acoustic energy in relationship with the total energy of impact is made. In a majority of the work areas, noise level is much above the safe value, which points to the desirability of adopting hearing conservation measures.

ELECTRONICS AND TELECOMMUNICATION ENGINEERING DIVISION

Design and Application of Transistorized Phase Angle Meter

S. K. Basu
Non-member
Dr. S. P. Patra
Associate Member
and
Prof. J. K. Choudhury
Non-member

This paper describes the design and construction of a transistorized phase angle meter for measuring phase angle between two sinusoidal alternating voltages of the

same frequency; it can also be used for measuring the power factor in an A.C. circuit. Though basically designed for use in a single-phase circuit, it can be adapted for measuring power factor in a balanced three phase circuit. The advantages of the instrument described in this paper over the conventional electrodynamic and moving iron type power factor meters are: (i) high input impedance of voltage circuit, (ii) negligible power consumption in test circuit, and (iii) good frequency characteristics.

Party Line Telephone Working Using a New Device

P. N. Das
Non-member

A new transistorized device is used for party line telephone working by which different subscribers can be separately and selectively called unlike the party line working in a C.B. system. In this method, the bell of the called subscriber only rings during calling and as many as twenty different subscribers may be included in the same party using the same pair of lines.

Near End Infra-red Filters for I. R. Communication Systems

K. R. Wadhera
Non-member

This paper relates to design and development of two types of infra-red filters to transmit the near end infra-red band and attenuate the visible as well as the far end infra-red bands: (i) plastic films of polyvinyl alcohol with two different dyes on glass plates, and (ii) plastic films of polyvinyl alcohol with two different dyes laminated between two glass plates. The filters are characterized by a transmission band from 0.8 to 2.6 microns with 70 to 80% transmittance over the transmission band, and with 3 to 10% transmittance over the attenuation bands. The effects of concentration of dyes and thickness of film on transmission characteristics are studied. Also, the effects of different dyes on the sharpness of cutoff is analyzed. These filters are used in the terminal equipment of an infrared communication system.

INSTITUTION NOTICES

Names of successful candidates in the Studentship and Associate Membership Examinations held in May 1964

SECTION B (Existing Scheme)

Roll No.	Name of candidate
1104B	D. Sreeramamurthy

Draft Indian Standards

1. The following draft Indian Standards have been issued recently.

Draft Indian Standard Method of Sampling and Grading Structural Granite—Doc : BDC 6 (741)

This Standard covers the selection, grading sampling, and testing of structural granite for specific construction uses.

Members may send their comments on the above draft Standard before July 5, 1965, to Shri T. R. Mehandru (*M.*), 14 Asaf Ali Road, Ajmeri Gate Extension, New Delhi, who is the Institution representative on the Sectional Committee dealing with the Standard.

2. Draft Indian Standard Specification for Paving Bricks—Doc : BDC 30 (934)

This Standard specifices dimensions, quality and strength and methods of sampling and test for clay paving brick for use in construction of pavements.

Members may send their comments on the above draft Standard before July 1, 1965, to Shri G. T. Gokhale (*M.*), Nirbhaya, 1961 Sadashivpeth, Hanumanbag Vasahat, Poona 2, who is the Institution representative on the Sectional Committee dealing with the Standard.

3. Draft Indian Standard Method of Test for Soils Part IV Grain Size Analysis—Doc : BDC 23 (867).

This method covers the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 micron I.S. sieve is determined by two methods of sieving, *viz.*, wet sieving applicable to all soils, and dry sieving applicable only to soils which do not have an appreciable amount of clay are given.

Members may send their comments on this Standard before July 20, 1965, to Shri C. G. Swaminathan (*A.M.*), Assistant Director, Central Road Research Institute, New Delhi 20, who is the Institution representative on the Sectional Committee dealing with this draft Standard.

Copies of the draft Indian Standards may be obtained from the office of the Indian Standard Institution, 9 Bahadur Shah Zafar Marg, New Delhi 1 ; or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay 1 ; 11 Sooterkin Street, 3rd Floor, Calcutta 13 ; 2/12 First Line Beach, Madras 1 ; or 14/69 Civil Lines, Kanpur.

INSTITUTION NEWS

Special General Meeting of Corporate Members, Bhubaneswar, May 2, 1965

A Special General Meeting of the Corporate Members of the Institution under Bye-law 82(b) (iii) had been called to be held in the building of the Orissa Centre of the Institution, Sachivalaya Marg, Unit IV, Bhubaneswar 1, at 3.30 p.m. on Sunday, 2nd May, 1965, to consider the requisition dated 26th December, 1964, signed by 143 Corporate Members, proposing certain amendments to Regulations 7(d) and 15(d) and deletion of Regulations 7(f) and 15(f) of the Council, along with Resolution 20 of the Council passed at their 439th Meeting held in Lucknow on 23rd February, 1965, in this connection. Both of these were given in the Schedule annexed to the Notice of the Meeting.

The attendance of Corporate Members was only 34 at 3.30 p.m. when the President took the Chair, while for a Special General Meeting Bye-law 90 specified a quorum of 50 Corporate Members. The President, therefore, referred to that Bye-law and read it out to the members present.

Some of the members thought they would like to discuss the position, and the President said they could do so but only informally. With the permission of the members present, he said he would give 30 minutes for this purpose and also to see if more Corporate Members would arrive in that time as provided in Bye-law 90.

In the informal discussion that ensued, some members thought that proxies could be taken into account to meet the requirement of the quorum of fifty Corporate Members, but others held that unless a quorum was available from the physical presence of 50 Corporate Members, the question of invoking proxies did not arise and that proxies could be invoked for purposes of voting only.

At 4.00 p.m., the President referred once again to Bye-law 90, and, in accordance with the concluding sentence of the text of that Bye-law which stated that 'If within thirty minutes after the time appointed for a Special General Meeting or an Extraordinary General Meeting, the requisite quorum is not present, the meeting shall be dissolved', gave a ruling that the Meeting was dissolved.

Mysore Engineers' Association Centenary Lecture

A detailed report on the amalgamation of The Mysore Engineers' Association with The Institution of Engineers (India) was published in the *Bulletin* dated June 1964 (pages 21-30). In accordance with the terms of the amalgamation the Mysore Engineers Centenary Lecture was instituted in 1964 and a provision for the grant of Rs. 1,000 has been made by the Institution to be paid honorarium as to the lecturer. The first lecture was delivered by Shri A. K. Char (*M.*), Chief Engineer, Chambal Project, Kota, during the 30th Annual General Meeting of the Mysore Centre held on December 26, 1964, and the title of the Lecture was 'Resources Development in Mysore—Past Achievemens and Future Possibilities.'

FORTHCOMING CONFERENCES

Thirty-fifth Annual Research Session of the Central Board of Irrigation and Power, Ranchi, June 25-July 3, 1965

The 35th Annual Research Session of the Central Board of Irrigation and Power will be held at Ranchi from June 25 to July 3, 1965. Papers on the following subjects will be discussed.

(i) Hydrology and irrigation, design of river valley structures

(ii) Construction materials and projects

(iii) Hydraulics—instrumentation, etc.

(iv) Hydraulics—theory

(v) Hydraulics—model studies for projects

(vi) Soil mechanics and foundation engineering

Further particulars can be obtained from the Secretary, Central Board of Irrigation and Power, Curzon Road, New Delhi 1.

Third Congress of CIB, Copenhagen, August 23-28, 1965

The Third Congress of the CIB (International Council for Building Research, Studies and Documentation) will be held in Copenhagen, Denmark, from August 23 to 28, Discussions will cover the following topics amongst others : needs and capacities ; the task facing the building industry in countries at different stages of development ; technical methods of advancing industrialization ; including project preparation, advanced forms of drawings and specifications, cost calculation, data processing, operational research ; site preparation, advanced methods of planning including CPM and PERT ; site mechanization ; prefabrication ; examples of operations, economic effects of siting of plant, transport, automation, size and capacity of factories, influence of length of series ; prefabrication of separate components, standardization and modular coordination ; integration of design and production including the need for an integrated building industry ; developments in the building materials industry : examination of functional requirements of building ; dissemination of information ; and research and training. Excursions, including a full day's excursion to Sweden, will be arranged to industrial building projects in Scandinavia. The full Congress programme, together with registration forms, may be obtained from the Director, Central Building Research Institute, Roorkee, U.P.

International Conference on the Microwave Behaviour of Ferrimagnetics and Plasmas, London, September 13-17, 1965

An international conference on 'The Microwave Behaviour of Ferrimagnetics and Plasmas' has been arranged to provide opportunities for the presentation of reports of the most recent research in the broad field of the microwave behaviour of ferrimagnetics and plasmas. This Conference, sponsored by the Electronics Division of the Institution of Electrical Engineers, The Institute of Electrical and Electronics Engineers, The Institution of Electronic and Radio Engineers, and The Institute of Physics and the Physical Society, will be held in London from September 13 to 17, 1965. The following related conferences are to be held immediately before this Conference : (i) 'Conference on Ionized Gases', Belgrade, from August 30 to September 4, 1965, and (ii) 'U.R.S.I. Symposium on Electromagnetic Theory', Delft, from September 6 to 11, 1965.

The scope of the Conference includes electromagnetic wave propagation in ferrimagnetics and plasmas and in structures containing these media ; microwave devices employing ferrimagnetic, anti-ferrimagnetic gaseous plasma and solid-state plasma media ; measurement of ferrimagnetic and plasma properties ; non-linear phenomena in ferrimagnetics and plasma ; electron beem interaction in ferrimagnetic and plasma structures ; studies of solid-state plasma phenomena including Gunn-effect phenomena ; electromagnetic-acoustic phenomena in ferrimagnetics and plasma.

Further details can be obtained from The Conference Secretariat, The Institution of Electrical Engineers, Savoy Place, London, W.C. 2.

International Conference on Thermionic Electrical Power Generation, London, September 20-25, 1965

An international conference on 'Thermionic Electrical Power Generation' organized by the Institution of Electrical Engineers, under the auspices of the O.E.C.D. European Nuclear Energy Agency will be held in London from September 20 to 25, 1965. The purpose of the Conference is to allow a broad-based discussion on the work of thermionic electrical power generation now under way in the different nuclear centres, national laboratories, universities, institutes and industrial laboratories, as well as to inform a wide audience of the latest developments in this technique. The Conference is intended mainly for research workers and technical staff actively engaged in thermionics research, and especially those interested in thermionic electrical power generation. All the papers submitted for this Conference must be connected with the use of thermionic conversion for electrical power generation and fall within one of the eight following topics :

(i) Convertor performance (*e.g.*, lifetime output characteristics)

(ii) Theoretical considerations

(iii) Surface phenomena

(iv) Measurement techniques and diagnostics (thermometry, optical spectra, calorimetry and probes)

(v) In-pile studies

(vi) Construction materials (*e.g.*, huclear fuels, emitter and collector materials, insulators and corrosion problems) ;

(vii) Application (nuclear reactor, solar, isotope and flame heating)

(viii) New developments (heat pipes and ion injection)

A full day technical visit will take place during the Conference to the Atomic Energy Research Establishment, Harwell. Other technical visits will be arranged on September 25, 1965.

Further details concerning the Conference and registration forms will be available about three months before the Conference from the Secretary, The Institution of Electrical Engineers, Savoy Place, London W.C.2.

Fifth International Congress of Precast Concrete Industry, London, May 21-22, 1966

The Fifth International Congress of the Precast Concrete Industry will be held at the Royal Festival Hall and the Royal Garden Hotel, London, from May 21 to 27, 1966.

The programme for the Congress will include an introductory review of outstanding achievements, followed by sessions on the following subjects :

(i) Structural precast concrete ;
(ii) International developments in machinery for the precast concrete industry ;
(iii) Concrete Pipes, culverts and tunnel segments ;
(iv) New Products, new techniques and outstanding applications ;
(v) Recent research on precast concrete ;
(vi) The architect and precast concrete ; and
(vii) Developments in the manufacture and use of concrete blocks.

Further particulars can be obtained from the Organizing Secretary, Fifth International Congress of the Precast Concrete Industry, Terminal House. Grosvenor Gardens, London, S.W. 1.

BOOK ACKNOWLEDGMENTS

1. **Planning and Designing Buildings.** Y. S. Sane. *Allies Book Stall,* Poona. Rs. 12, 2nd edition, 1964, 229 pages.

This second edition of a book is meant for students studying for a degree or diploma in civil engineering and architecture. The various chapters in the book are written using the metric system. Principles of planning and requirements of design of buildings such as residential, hospital, market, factory, etc. are given. A table for conversion in equivalent metric dimensions is given. Some project drawings are also included.

2. **Tacheometric Tables.** F. A. Redmond. *Asia Publishing House,* Bombay. Rs. 15, 1961, 256 pages.

Tacheometry, a very useful and advanced form of surveying, has been rendered simple in this book. A sound knowledge of elementary surveying is presumed on the part of the surveyor who is likely to refer to the compact and conveniently arranged tables provided in the book, which give the horizontal and vertical distances required by the surveyor from staff intercepts read into a tacheometer. In the main table, the angles range from 0° to 20° by 20 ft. intervals and the distances from 50 to 850 ft.

3. **Concrete Mix Design.** J. D. McIntosh. *Cement and Concrete Association,* London. 25 s., 1964, 112 pages.

The subject matter in the book deals with methods by which suitable mix proportions can be estimated from a knowledge of the properties of the available materials and the mix design data which have been recorded. Descriptions are given covering the underlying principles applicable at all stages of designing a mix ; once the methods of making the preliminary calculations are known, the estimate of suitable mix proportions for given conditions and materials can be completed easily. The illustrations and tables included in the book will prove useful as much to those who are responsible for preparing specifications as to those who have to work to them in practice.

4. **Adhesive Materials—Their Properties and Usage.** I. Katz. *Foster Publishing Co.*, California. $ 9.50, 1964, 440 pages.

In this book, industrial and international specifications, are given for adhesives, binders, cements, glues, mortars, mucilages, pastes, and gummed and pressure sensitive adhesives. The book provides the reader with a picture of the different types of adhesives used for joining metals, and gives the precise chemical, physical, process and performance characteristics of the adhesive in the intended application. The first part of the book guides the reader as to the use of proper adhesives for wood, metals, plastics, optical and electrical purposes. The second part gives the details necessary for using the adhesive and the result.

5. **Gears—Spur, Helical, Bevel and Worm.** P. S. Houghton. *Asia Publishing House*, Bombay. Rs. 32, 1961, 390 pages.

The book provides useful information in regard to the various classes of gears such as spur, helical, bevel and worm, and will be helpful to the draughtsman, the shop superintendent and the foreman, the mechanic in the fitting or repair section, the personnel in the inspection department, and the student of engineering. The illustrations and the bibliography provided in the book considerably enhance the utility of the book.

6. **Jigs, Tools and Fixtures—Their Drawing and Design.** P. Gates. *Asia Publishing House*, Bombay. Rs. 16.50, 5th edition, 1964, 215 pages.

Basic principles underlying the operation of certain essential component parts of the modern machine tool have been explained and illustrated in this book. The new matter included in this fifth edition of the book are the chapters on 'indexing mechanisms'. 'press tools', and new production techniques in the appropriate sections. The book will be of help to the apprentice in the machine shop as well as to the junior in the drawing office.

7. **Manual of Tractors.** J. Konrad. *Asia Publishing House*, Bombay. Rs. 16, 1964, 240 pages.

This book is intended specially for tractorists who know how to drive tractors but wish to improve their knowledge of the mode of operation and functioning of engines. Particular attention has been paid to the description of the design and mode of operation of the engine and the functions of its units. Included in the book are numerous hints and tips, and at the end of each section a summary of the maintenance and repair work involved.

8. **Electrical Installation.** H. Graff. *Asia Publishing House*, Bombay. Rs. 7.75, 1964, 180 pages.

This book is intended for workers and apprentices who are qualifying as expert workers in the field of electrical installation. Detailed descriptions of graphical symbols used in electrical engineering and in explaining the preparation of simple diagrams together with details of the manual skills required for properly laying electric lines above the ground and underground and in buildings, and of the installation and maintenance of electric equipment and appliances are given. The several illustrations, sketches and diagrams considerably facilitate the grasping of the technical and physical interrelations which are rather complicated in several instance.

9. **Telecommunications—the General Principles.** J. Brown and E. V. D. Glazier. *Chapman and Hall Ltd.* 18 s., 1964, 370 pages.

This low-priced textbook deals with the general principles of telecommunications. The book is designed to meet the needs of university or technical college students reading for a first degree or a diploma in technology. The reader is assumed to have a good knowledge of A.C. circuit theory and an elementary knowledge of electromagnetic wave propagation and electronic theory. Since the Fourier integral method of dealing with non-periodic waveform is the most instructive approach to a study of telecommunication principles, the main text is largely concerned with providing a physical grasp of the essentials of this method. A more detailed mathematical treatment including the relation to other methods of network analysis is given in appendix A. Appendix B deals with Bessel Functions.

10. **A History of Cementing Materials from Antiquity to the Middle of the Nineteenth Century** (Russian). I. L. Znatchko-Javorsky. *Academy of Sciences of the U.S.S.R.*, 1963, 496 pages.

The book is mainly intended for cement chemists and technologists, personnel connected with construction engineering and architecture, archaeologists and historians. It contains a comprehensive study of the history of the development of chemistry and technology of cementing materials from anquituity to the creation of Portland cement. The data obtained are estimated from the point of view of past and present scientific and technical concepts. Study of new sources of research and the application of new methods resulting in new conclusions and a comprehensive picture of the history of cementing materials have been incorporated in the book.

PUBLICATIONS RECEIVED

A copy of the 'CPC Newsletter Annual 1964' of the Calcutta Productivity Council, 9 Syed Amir Ali Avenue, Calcutta 17, has been received. The annual contains interesting articles on management, preventive maintenance, work study, productivity, programme evaluation review technique, etc.

A copy of the publication titled 'Oil and Gas Exploration' has been received from the Information Department of the U.S.S.R. Embassy in India, 25 Barakhamba Road, New Delhi. The publication gives a short sketch of Soviet cooperation and assistance rendered in exploring oil in India and in developing India's national oil industry.

A copy of the publication titled 'Bombay Technological Institute' has been received from the Information Department of the U.S.S.R. Embassy in India, 25 Barakhamba Road, New Delhi. The publication gives a short history of the I.I.T. at Powai, the help rendered by the U.S.S.R., the courses of studies offered, etc.,

A copy of the January 1965 issue of 'Indian Science Abstracts' has been received from the Indian Scientific Documentation Centre, Hillside Road, Delhi 12. Original articles including short communications, review and infomative articles published in scientific and technical periodicals, proceedings of conferences and symposia, monographs and other *ad hoc* publications, as well as patents and standards, are abstracted in this monthly periodical.

A copy of joint committee report on 'Fully Rigid Multistorey Welded Steel Frames' has been received from The Institution of Structural Engineers, 11 Upper Belgrave Street, London S.W. 1. The Joint Committee was appointed in January 1957 with the following terms of reference : 'To consider the preparation of a report on recommendations for the design and construction of fully rigid welded multistorey steel frames'.

A copy of 'Productivity', vol. 5, no. 4, winter 1964, has been received from the National Productivity Council, 38 Golf Links, New Delhi 3. This issue contains a special section on preventive maintenance, and articles on span of control, PERT, etc.

A copy of October-December 1964 issue of 'Technology'—Quarterly *Bulletin* of the Planning and Development Division, Fertilizer Corporation of India, Ltd., Sindri, has been received. This issue contains articles on the different aspects of fertilizer manufacture and application of fertilizers, short communications, technical digests, etc.

Corrigenda

TO VOL. 13, NO. 10, JUNE 1964

Page 48, Roll No. 5076A, instead of 'K. B. Palaniswami', please read 'K. A. Palaniswami'.

TO VOL. 14, NO. 7, MARCH 1965

Page 55, under Orissa Centre, please read

1. M 2977 P. Achyutham (E)
Executive Engineer, Planning and Development,
Orissa State Electricity Board, Bhubaneswar.

Page 60, under Rajasthan Centre, please read

14. M 2354 R. L. Malhotra (C)
Chief Technical Examiner, Rana Pratap Sagar and Kota Dams, Kota.

20. AM 4890 G. S. Sastry (C)
Superintending Engineer, Rajasthan Cana Project, Suratgarh. District Sri Ganganagar.

OBITUARY

The sympathy of the Institution is extended to the relatives of those whose passing is recorded here.

Shri S. Ramchandra

Shri Subramonia Ramchandra, B.E., M.I.E., died on March 17, 1965.

Born in April 24, 1896, at Trivandrum, Shri Ramchandra obtained his B.E. degree in Mechanical Engineering from the Madras University in 1920. After completing his apprenticeship in the Railway Workshop at Perambur, Madras, he joined as the head of the Shri Mulam Technical School, Trivandrum, in 1921. In 1924, he joined the P.W.D. of the then Travancore State, where he worked in various capacities and rose to the position of Chief Engineer. During the years 1945-48, he was working as Sanitary Engineer to the Government of Madras. In 1948, he joined the College of Engineering, Trivandrum, as Principal and retired from this position in 1951. Shri Ramchandra was responsible for the design and erection of the underground drainage systems in Trivandrum and in the Madras State.

Shri Ramchandra joined the Institution as Associate Member in 1949 and was transferred to Member in 1950. He was Chairman of the Travancore-Cochin Centre for the year 1950-51.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organisations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

ELECTRICAL ENGINEER, B.Sc., B.E.E., A M.I.E., 35 years old, with 12 years experience, 5 years in India in transmission and utilization, and 7 years in the U.K. in research, design, administration and export work; multitilinguist with social graces, seeks senior executive position in planning, technical administration or overseas sales. (Office ref. E.S. 192)

SENIOR CHEMICAL ENGINEER, B.E., A.M.I.E., A.M.I.I. (Chem.) E., having about ten years experience in production, erection and commissioning and planning and development sections of a large paper mill in India, knowing Telugu, Tamil and Hindi languages, seeks a suitable change with a view to utilize the talents in a better way to the nation in any reputed concern in senior position in production, planning and development, consultation bureau and administration. (Office ref. E.S. 193)

YOUNG CIVIL ENGINEER, B.E., Grad. I.E., with two and half years experience in civil engineering works seeks suitable change. Present salary is Rs. 510 p.m. and gazetted position. (Office ref. E.S. 194)

ROORKEE QUALIFIED CIVIL ENGINEER with over 25 years experience in construction of dams, canals, tubewells seeks employment. (Office ref. E.S. 195)

ELECTRONIC ENGINEER (29) with Diploma in Radio Engineering and passed Sections A and B (Electronics and Telecommunication Engineering Division) of the Associate Membership Examination of the Institution of Engineers (India), having 5 years experience in civil aviation department and 3 years as a Class II Gazetted Officer in a State organization, fully conversant with all types of communication, navigational and test equipments including V.H.F. and F.M. systems. Available for immediate appointment in any responsible capacity in sales, service or design department. (Office ref. E.S. 196

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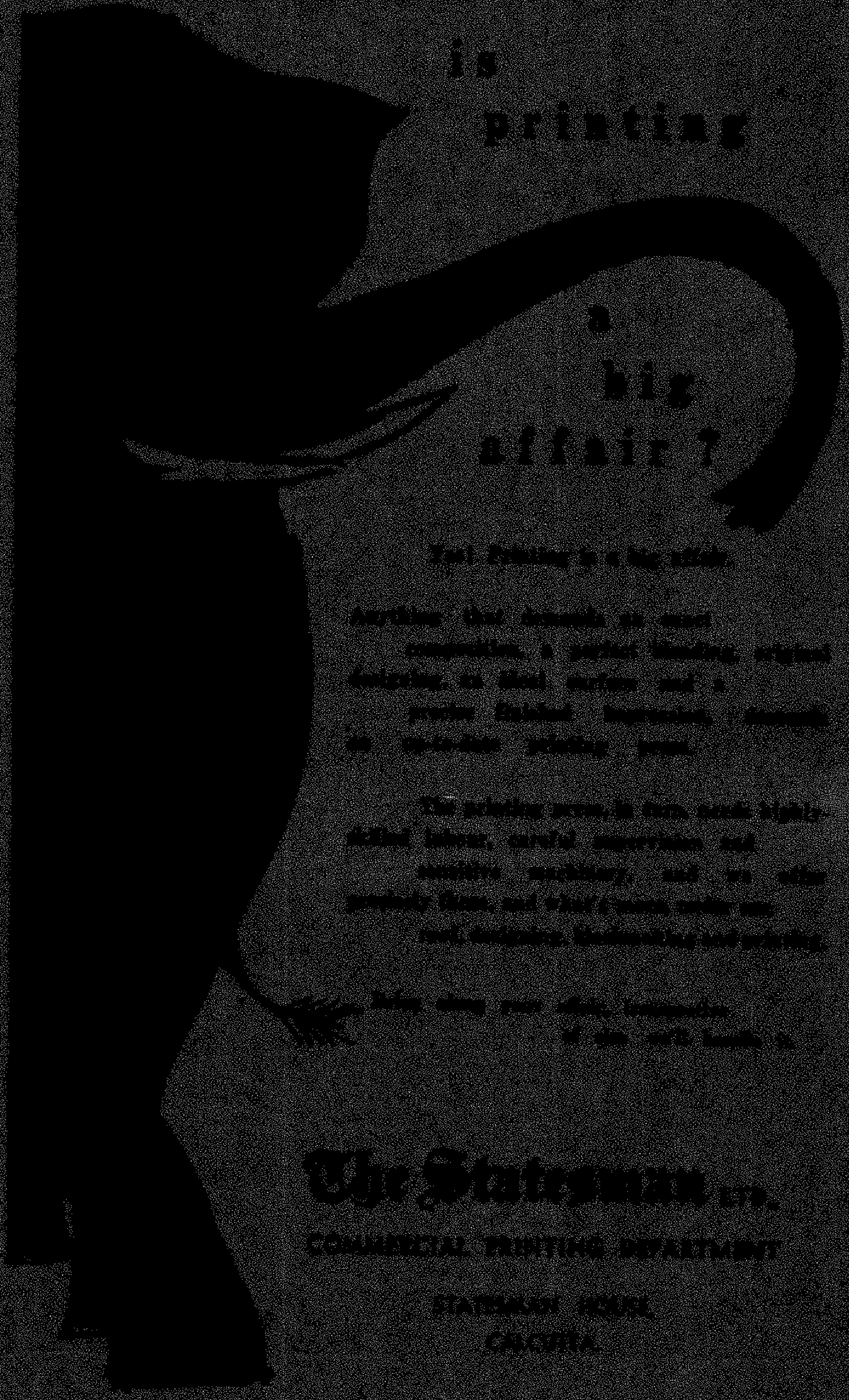

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The Council has directed that hereafter all payments to the Institution shall **only** be made :

(1) by demand draft drawn on a Calcutta bank or by cheque sent by post (70 p. being included as bank charges in the case of an outstation cheque);

(2) in cash tendered at any branch in India of the State Bank of India along with bank-cards A and B;

(3) in cash, cheque or demand draft deposited at the cash counter of the office of the Institution Headquarters in Calcutta; and

(4) by postal order to a maximum of Rs. 10 for the cost of publications and Studentship application registration fee only.

Please note that any payment by money order or by postal orders other than as mentioned in (4) above cannot be accepted.

ADVERTISEMENTS IN THE INSTITUTION'S PUBLICATIONS

Members are well aware that the existing inflationary conditions compel the Institution to seek every possible means to supplement its income in order to combat the rising costs, so that the services to its members and the engineering profession as a whole will not only be maintained but expanded. Costs have particular validity when the Institution's publications are concerned, the scale and scope of which are unprecedented for any organisation in this country.

The Headquarters, therefore, consider it necessary to do all they rightfully can to increase the quantity of advertisements in the publications. A greater number of advertisement pages would be of real help in offsetting some of the expenses of the publications.

It is stressed that the Journal in all its Parts, the Bulletin and the Year-Book have also a large circulation oversea and suitable advertisements in them can materially aid the present drive to export more of India's engineering products. There is also great scope for advertisement of the products and equipment supplied by constructional, light engineering and ancillary industries, and for firms whose goods and services will appeal to members as individuals. The Headquarters believe that these publications are the most attractive media for this type of advertisement and that many members connected with firms would be glad to use this means of publicizing their activities. Also, as increasing proportion of commercial and executive positions in industrial, contracting and public organisations become occupied by professional engineers, so do the publications reach more and more to those to whom engineering advertisements are directly useful.

Members whose positions enable them to help the Headquarters in this effort are requested to bring to the notice of publicity managers the merits of the Institution's publications as channels for reaching purchasers of engineering equipment. A brochure giving full particulars of rates and other information may be obtained from the Technical Officer (Scientific) at the Headquarters at 8 Gokhale Road, Calcutta 20.

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The Institution of Engineers (India)

SECRETARY & EDITOR : B. Seshadri, B.Sc., A.I.I.Sc., D.I.C. M.Sc.(Eng.), M.I.E.
TECHNICAL EDITOR : B. R. Subramanyam, B.Sc., B.E., A.M.I.E.

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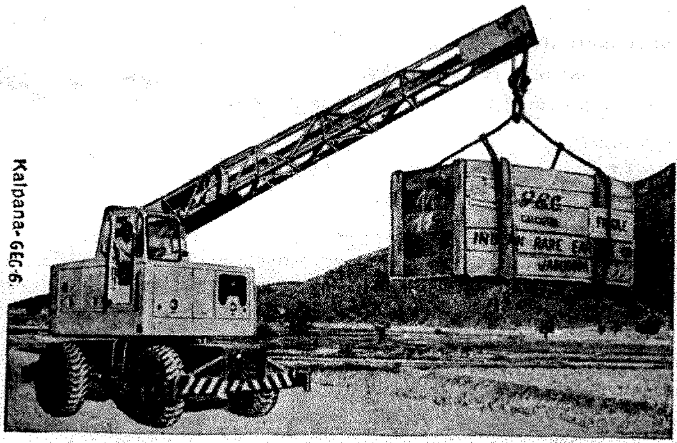

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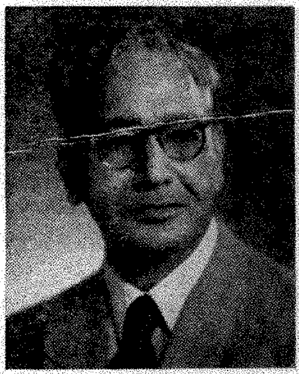
ADDRESS OF DR. A. N. KHOSLA, GOVERNOR OF ORISSA, AT THE 441ST MEETING OF THE COUNCIL AT BHUBANESWAR ON MAY 2, 1965

'I am most happy that for the first time you are holding the Council meeting at Bhubaneswar. It is a recognition of the increasing engineering activity and interest in the State. It is also an august occasion for this newly constructed Institution building of the Orissa Centre where this Council meeting is being held.



Orissa is a land of ancient architecture. It is also the land of arts which find expression in sculptures and in the exquisite forms of Odissi dance, drama and music. The great temples of Bhubaneswar, Konarak and Puri bear testimony to the art and architecture of Orissa and the fine traditions of ancient engineering. In the olden days, Orissa was a great maritime power and well advanced in the maritime engineering of that day. I hope it will be possible for you gentlemen to find the time to see some of the glories of Orissa and enjoy the beauties of nature and art of man.

It has been my privilege to be associated with the Institution for over 30 years. About 15 years ago, I had the honour to be your President for two consecutive years. With my present responsibilities, it has been difficult for me to keep in close touch with the affairs of the Institution, but I have been watching with much pleasure the steady growth which this Institution has made despite many difficulties and handicaps. The total number on the Roll of the Institution is said to be nearly 56,000, including a large percentage of Student engineers. The increase in enrolment has been placed at roughly 8,000 per year and it is fast mounting up. With the rise in the number of its Corporate Members and Students, the Institution will be progressively faced with responsibilities and problems of increasing complexity.

One of the major problems of the Institution has been the status and fate of the Royal Charter. This is said to have been satisfactorily resolved and the new Bye-Laws introduced. Thus, the Institution now stands on a stable legal footing.

I am glad to note that of late the technical activity of your Institution has increased considerably. The formation of seven Engineering Divisions, each representing a particular branch of engineering, has been a move in the right direction, and has saved the Institution from insidious attempts from certain professional sub-groups at subverting its all-comprehensive and all-India character.

The Institution is meant to be the repository of all engineering knowledge from the ancient to the most modern and also the custodian of the engineering profession and its ethics. The Institution will have to devote greater and greater attention to these basic responsibilities. Any engineer, who has the privilege of calling himself a Corporate Member of this Institution, must have breadth of knowledge and high ethical standards.

This Institution has had the honour of having on its Roll one of the greatest engineers of our time, the late Sir M. Visvesvaraya, who was awarded the highest honour of the land, the *Bharat Ratna*. Members of your Institution are holding high positions in government, industry and the various public and private undertakings. One of your Past-Presidents, Dr. K. L. Rao, is the Union Minister for Irrigation and Power. Another Past-President, Prof. M. S. Thacker, is Member, Planning Commission. With the present trend of industrial and economic development and the technological revolution that is already gripping the country, there will be vast opportunities for engineers to fill up positions of the highest responsibility, technical, administrative and managerial. In Germany, most of the top managerial positions in industrial undertakings are manned by engineers. In the U.S.A., I understand, 36 per cent of the managerial positions in technological undertakings and even others are held by men with high technical qualifications. Similar is said to be the situation in the U.S.S.R.

An engineer by training is equipped for leadership and decision making. He has to be a planner, an organizer, an administrator, a welfare officer, and a builder. He has to deal with men and machines. Human relations are an essential part of his training. He has to strike a happy balance between men and machines in major construction jobs with due regard to economy, speed and need for employment. He must be a man of sound judgment and quick grasp to be able to take quick decisions and ensure expeditious and economical implementation. He must be time and cost conscious and have adequate appreciation of the infractuous cost involved in indecision and delay. His administration must be achievement-oriented and not merely subserve paper and procedural rectitude. Field rather than office routine should occupy most of his time and thinking. With these assured, high efficiency, quality, expedition, integrity, and reduction in costs will be the natural results.

Our engineers have outstanding achievements to their credit in the field of river-valley development such as Bhakra, Hirakud, Koyna, Rihand, D.V.C., Kosi and other projects; railways, power plants, including atomic stations, buildings, roads, bridges and a host of major and minor industries. The standard of planning, organization, quality, expedition and economics have been mostly of a high order. There have been lapses here and there for various reasons, but the achievements have been highly creditable, particularly in view of the fact that after independence, the tempo of development was much faster than could be sustained by available technical manpower in numbers and adequate experience.

In my recent tour to Gujarat, I was struck by the achievements of the Anand Milk Union, Ltd., otherwise known as AMUL, a cooperative enterprise with 70,000 members under the dynamic and purposeful leadership of a mechanical engineer, who has virtually carved out a milk empire in Gujarat and developed cooperative effort to near perfection. His creative genius has brought into being one of the finest milk factories at Anand and a chain of similar milk factories in other parts of Gujarat and elsewhere. A special feature of the Anand Milk Factory is the flowering of indigenous talent and innovation. Indigenous manufacture and fabrication were being taken up on a large scale. I make special mention of this because of the engineers' creative achievement which will compare favourably with any similar venture anywhere in the world. Shri V. Kurian is the engineer in question.

In my estimation, an engineer should be ranked in merit and for undertaking high responsibilities, not on the basis of his length of service, the position he holds or the salary he gets, but on the basis of his creative achievement and his contribution to engineering knowledge and human welfare.

This Institution has made a worthwhile contribution in increasing the output of engineers at a crucial stage in our Five Year Plans through earn-and-learn programmes and a well-planned system of examinations, and thus relieved to some extent the heavy strain on technical personnel and financial resources of the existing and new technical institutions.

The major object of the Institution is the promotion and pooling of engineering knowledge and research with a view to their application in developmental activity, providing indigenous expertize in all branches of engineering and making Indian engineering and industry independent, as far as possible, of foreign consultants, foreign expertize and foreign machinery.

Our engineers have to be equipped to meet the challenge of the nuclear and space-age. Spirit of enquiry, creativity and self-confidence and self-reliance must be the watchword in all our plans of technical and scientific education and training, so that it may be possible for us, not only to solve our own problems but also to contribute to the world pool of scientific and technological knowledge.

To stimulate spirit of engineering and creativity among engineers, they must have a wider grounding in basic sciences needing a radical change in our engineering curricula. There must be a strong bias in favour of basic sciences and creative research. This should be one of the major tasks of the Institution. To bring about this most urgent change, the Institution must advance with crusading zeal in its mission of creative achievement, efficiency and effective service to the nation.

We have to appreciate that science and engineering are only two different facets of the same entity. Research in basic sciences leads to new knowledge. It provides scientific capital which creates the fund from which the practical application of knowledge must be drawn. Basic research is also the pace-maker of technological research. Science creates new ideas. Engineering faced with unsolved problems seeks new knowledge and thus stimulates further scientific investigation. It also provides new tools, materials and techniques for science and for the exploitation of previous scientific breakthroughs. The interplay of science and engineering have brought about discoveries and innovations to meet the demands of modern society.

Another field in which the Institution can make a worthwhile contribution is the development of consulting engineering services in designs, construction, equipment, processes, etc., for all branches of engineering and industrial technology. The Institution should think of ways and means of how best to develop these consulting services on an all-India basis or at the Local Centres. Such services must be of a really high order and available to the small enrepreneur, the big industrialist, the builder, the designer, etc. at a level of competency and efficiency comparable with that available with similar foreign firms.

The holding of seminars is another fruitful field for the Institution to enter. One such seminar was held in New Delhi in November, 1961 on 'Efficiency and Economy of Engineering Enterprises in India'. It was brought out in that seminar that the field of engineering enterprises in the Third Plan accounted for 62 per cent of the total investment during the Plan. Attention was drawn to the need for efficiency and economy in the execution and management of these enterprises, if maximum economy, speed and quality were to be achieved. Similar seminars in various aspects of engineering will greatly help in stimulating fresh thinking and concretizing ideas on modern needs and how best to meet them. They will also help in bringing knowledge in various fields up-to-date.

Refresher courses is another fruitful field of activity for the same purpose.

To better the economics of any undertaking, it is necessary for all engineers to have additional training in work study and material management.

To solve the problem of unemployment among the educated, all education in the schools whether in sciences or in arts should be given a vocational or technological bias. This may be achieved by introducing elements of technology in the curricula coupled with stress on allied hobbies.

Now, a word about the inter-relationship between engineering, administration and finance. Engineering, finance and administration are the three key-factors of any engineering enterprise. Engineering training is designed to equip a man for technical as well as managerial duties in order that he may be able to exercise effective control over quality, costs and time-schedules. On projects involving technology and management, the technical man should have the supreme say.

There should really be no clash between engineering, finance and administration. They are all complementary. The best results can be obtained by team-work, without show of bossism or superiority in any form, between the engineer, the finance officer and the administrator, and an unfailing desire on the part of all to serve the common objective of achieving maximum results at minimum cost in the shortest time. It will be fatal for anyone of these to operate as a brake to progress, efficiency and economy through false notions of prestige or loyality to any particular service label. Achievement is the objective. Procedural and paper rectitude are only means to the end and must not be allowed to become the end itself. I say so because, unfortunately, too often, achievement is made subservient to procedure and regulatory paper work.

There has been, and continues to be, a lot of irritation and even frustration among the engineers because of the dominance of administrators in the day-to-day decisions of engineers even in technical and organizational matters. This is an unhealthy state of affairs and is bound to undermine efficiency, unless the causes leading to such irritation and frustration are removed after a rational stock-taking of the various factors involved. Parity in pay scales and social status is one of the major factors. A particular service label does not necessarily entitle an individual to head an enterprise. The main criterion must be not the service label nor the order of standing in the queue, but merit and the capacity for creative achievement.

Engineers must be more and more associated with planning and policy making and the results in performance and achievement will amply justify this new innovation.

Today we are faced with the twin menace from China and Pakistan. The situation will demand the services of a large number of engineers of all categories, at the front, at the factories, at agriculture, and at all the other sectors of economy which are vital to the defence of the country. I am sure that when the call comes one and all of our engineers will place their services unreservedly at the disposal of the country and will be prepared for the highest sacrifice in the discharge of their duty to the country. The wars of today are not the wars in the battle front only. They are in esssence total wars on all fronts—defence, industry, agriculture and the day-to-day life of the people.

As an old Member of the Institution, and one of its Past-Presidents, I feel happy that you have all come over here for holding your Council meeting. It will certainly prove to be a great encouragement to the local centre and stimulate them to greater effort in providing, among other things, an up-to-date library and other measures, which would bring to the engineers of Orissa the benefit of up-to-date knowledge in all branches of engineering and technology, including those bearing on agriculture and industry.

I sincerely hope that your discussions will be fruitful in strengthening the objectives of this great Institution and that you will carry with you happy memories of your stay in Bhubaneswar.'

ENGINEERS' ROLE IN BUSINESS MANAGEMENT

C. K. Chokshi

Member

Introduction

Due to alround expansion of industrial activities in our country at the moment in the private as well as public sectors, the managerial functions have become important and complex. Most of the industries are connected with one or the other branch of engineering or technology, and as such basically all the industries can be termed as 'engineering-*cum*-technological' industries without the slightest hesitation. In spite of this, engineers or other technically qualified persons are least considered as suitable candidates for managerial posts. Therefore, naturally, the question arises as to why such a state of affairs is existing. In order to answer this question, it is necessary to know what are the essential requirements and functions of the management, so as to find out whether technical persons can do justice to them or not. The subject of business management has been hitherto considered non-engineering and non-technical and as such to some extent, it has been disregarded by engineers. This indifference to this aspect of the business by the engineers has been perhaps taken advantage of by other non-technical personnel in occupying high managerial posts. The writer has tried to put in a nutshell form the basic requirements of the management with which engineers have also to be conversant.

Why engineers are not given opportunity?

In order to analyze the present situation regarding employment of engineers in the management, we have to review our present industries. All industries can be very broadly grouped into the following four divisions in order to analyze the present situation in general :

(i) Industries owned by public limited companies with very large capital ;

(ii) Industries owned by public limited companies with medium as well as small capital ;

(iii) Proprietary concerns ; and

(iv) Industries in public sector.

Of all the above groups, position seems somewhat satisfactory in the industries owned by a few public companies with large capital, where either suitable engineers or other suitably qualified persons are given the opportunities to act as business managers or even as executive directors. Perhaps there is no other alternative for the management but to do so, as most of the senior directors who are on the directorial board are engaged in multifarious activities, and have either not the time or the necessity and desire to tie themselves down to one post. Therefore, in such concerns, engineers as well as other really qualified and experienced personnel are given opportunities to occupy managerial posts.

Barring a few such concerns falling into the first group, the position in the industries falling in the remaining three groups is not at all satisfactory and engineers are not given full opportunity to occupy managerial and other high executive posts, save in very exceptional cases.

In medium size concerns, the few persons who have floated the concerns initially with their own and their friends' investments are usually on the directorial board even though their share of investment may be very small compared with the total investment. They want to discharge the managerial functions themselves irrespective of their qualifications or experience. Therefore they work in such capacities and other proper persons are hardly given the opportunity to function in such posts.

In proprietory concerns, the proprietors will have invested their money and as they do not trust others usually, they themselves discharge managerial duties, whether they are fit or not.

In public sector concerns also, the situation is unsatisfactory. The government which is mostly made up of non-technical persons have no confidence in the managerial abilities of engineers or other technical personnel and therefore they invariably appoint an I.C.S. or an I.A.S. at the head of such concerns. In the bureaucratic form of government, there is no place for technical persons and they have to play a role far below the grade. It is generally argued that the vision of technical persons would be rather limited, narrow and mostly technical, and therefore, they are unsuitable for the top management. It is therefore necessary to understand and examine the managerial functions.

What is business management ?

When goods or services are produced, distributed and sold, a business comes into being. When a business is started, it is understood and taken for granted that it is started solely with a view to earn reasonable profits from the money invested, whether by an individual or a group. Therefore, the management has to see that it has to satisfy customers by selling their products at reasonable rates on the one side, and satisfy the workers and earn reasonable profits for the investors or share-holders on the other side. An efficient management should be able to supervise all the operations and activities starting from manufacturing to selling effectively and smoothly, and maintain harmonious relations with their staff and workers on the one hand and the customers on the other hand. The task of management in this post-war period has become much more complex than it was in pre-war days due to various factors. With the impact of communism and social awakening in the masses, and the bureaucratic approach of the government with all types of controls, formalities and heavy taxation, the functions of the management have become manifold and non-technical functions have gained predominance over the technical. In our country, we are plagued with one more difficulty, and the trade unions are not functioning strictly on healthy trade unionism rules but with political aims in view.

The business function is today a great deal more than making something or providing a service. The involvement is great. It includes recognizing responsibilities to workers, and to setting vigilant standards of production or service which will not debase the business function. This may sound pious and unreal, but if the principle of true enterprise is to survive, business cannot shut its eyes to this aspect.

Basic functions of management

Modern times calls for a three-fold job on the part of the management. All the functions of the management can be grouped into three broad divisions, namely, (i) technical, (ii) commercial, and (iii) social.

In this technological age, there are very few management tasks that do not call for a general understanding of technological operations. The technical division must be responsible for economical production, and constantly look out for increasing production and effecting economy by increasing efficiency, and introducing new methods, new processes and incorporating new developments and ideas, of course, suitably. The commercial wing has to look after proper distribution, selling and overall administration, while the social side has to look after the welfare of the staff and the workers, by providing amenities and maintaining very cordial relations between the top management, the staff and the workers. In fact, the social side should be responsible for the human side of the management, which is also of great importance in the present day when the country's goal is the achievement of a socialistic pattern of society.

Essential requirements of management

The management must have quite clear and definite ideas about the policy to be followed and the objectives to be achieved. It should be the main policy maker and should provide objectives and leadership. The top management should bear the responsibilities for working the objectives. The ability for taking correct and prompt decisions comes from a clear picture of what is required, and this in turn, is achieved by clear thinking. Therefore, the most essential requirement for the management is the ability to think clearly. This ability in the management instils confidence in the subordinate staff which is ready to receive and implement orders from the management, because the subordinates know where they stand. Even bad decisions can often be better than no decisions at all.

The orders from the management should be unambiguous and clear. This will not only create respect for the management but the efficiency in the implementation of the instructions will also increase tremendously.

Next, in order to attain the objectives, it is absolutely necessary to have an organization. The management has to evolve a proper organization and suitable organizational procedures. It is to be noted that defining of objectives and evolution of an organization are not enough. It has simply the beginning, and the end is in the successful pursuit of the objectives.

For an efficient organization, it is necessary to identify and group the activities and fix the duties and responsibilities of the various groups and individuals. It would also be necessary to work out the most suitable and procedural framework.

The following are the general rules to be followed for any organization:

(i) Duties and responsibilities of executives should be defined clearly;

(ii) Each department or section should have one main duty and should be under an executive;

(iii) The number of subordinates responsible to one executive should be limited;

(iv) Secondary duties should be given to executives who are capable of looking after two sections at the same time; and

(v) There should be the maximum delegation of optional responsibility with adequate safeguards for management control.

One of the major tasks of the management is to take decisions and as it becomes more technical and more complex, more and more decisions will have to be taken. While some are major decisions, certain decisions are of a minor nature and on routine matters. Therefore, in order to take quick decisions and to see that the work, in the meantime, is not held up, all other decisions, except the major ones involving policy-making and finance or similar matters, should be left by the management to the executives. This means the management should delegate powers in certain matters to its executives and subordinates.

This delegation of power will free the management from unimportant and routine matters so that they have enough time to think ahead, take major decisions, arrange coordination, and pursue the main objectives.

Another very important function of the management in the present day is to see that members of the staff and the workers are well looked after and properly taken care of, so that no causes are given unnecessarily for dissatisfaction among them simply due to lack of attention. It is also necessary for the management to create a picture among the workers that while they are ready to do their best for them, they will not put up with any nonsense.

Another important quality for the management is the power to communicate. Not only it is necessary to fix clear responsibilities on different heads or sections, and issue clear and unambiguous instructions, but it is necessary to create an atmosphere of mutual goodwill based on knowledge of what is going on. Mostly, there is a tendency on the part of the top management to keep aloof and be surrounded in a mysterious atmosphere. Secrecy is to be observed only when necessary, but usual ordinary matters and routines must be well communicated down to the last man, but they have to know when and how to communicate and to whom.

Humanity, intelligence and enthusiasm are other essential qualities for the top management.

Managerial qualities

The manager, or whatever name is given to the person who looks after the business directly, is the key figure in any industry or business. He is the focus of all the activities, and as such the success of the business depends considerably on his personal traits.

The foremost trait in him should be the quality of leadership. He must possess all the qualities of a good leader. He must have sincerity and integrity. True, integrity lies precisely in the ability to admit when one is fogged, when the issue is not clear, when, with the best willingness, a subordinate's argument is simply not understood. Nothing is more likely to undermine the prestige of a manager than the discovery that he is bluffing.

He is always prone to get into a routine, and once he forms a routine, it becomes impossible for him to break it and to come out of it. Therefore, it is very essential that he should force himself to rise above the routines of his job. He must avoid prejudice and preconception. He should not be dogmatic and must always have an open mind. He should strive all the time to ripen his mind by reading as many books, seeing as many plays and films, and travelling and talking to as many people as of course time will allow.

As the manager has to manage people besides managing the business proper, he should be sympathetic to others. But at the same time, he has got to be firm and fearless when occasion demands. Sometimes, some persons in authority go to tortuous lengths to avoid speaking frankly and fearlessly to a subordinate about a fault. To try to find less straightforward ways of telling a man when he is at fault, to employ a third party, or to trump up some irrelevant device is the opposite of good management. These are only some of the qualities required for managership. It can be said that the job of the manager is to retain the confidence of those he is managing. Without such confidence, his authority is dissipated.

Good management must concern itself with getting the maximum possible from the manager; and good leadership must see to it that this maximum is achieved in harmony and with understanding.

Conclusions

The author has tried to give in the above paragraphs some of the basic functions and requirements of the management only. It is impossible to define or describe the management clearly as the management function is so subtle, its application so diverse, and its interpretations and interpreters so varied that there are no clear-cut functions and duties.

In the present times, the management hazards are less because of the availability of more and more clearly defined systems of control on production, sales and finance, and it is thus able to eliminate the hit or miss method hitherto being followed. But, on the other hand, the real hazard is due to infusion of politics in industries by way of affiliation of trade unions with different political parties, bureaucratic approach of the government, heavy taxations, etc. and an element of uncertainty in the changes in the laws every year.

Thus, when the management has to fight on many fronts, a good leadership is very essential. Neither work study nor market research nor budgetary control is of value if the leadership element is lacking A good management has to combine technical aspects of the management with the human side also, as the management cannot function smoothly and properly if the staff and the workers feel dissatisfied and discharge their duties under disgruntled conditions.

In these days of spiralling costs and growing demands of workers for higher wages and benefits, and the government being very sympathetic to the workers, the task of management is not at all easy. However, in spite of all these difficulties, the business must go ahead and must run at a profit, and therefore the management has to function efficiently and has to be always on the look out for better methods of production, distribution and sales. They must watch for new processes, new equipment and new methods and go on assimilating them suitably in their business, to cope with the tremendous allround development in technological processes and methods taking place in the other countries of the world. It is therefore beyond doubt that a technically qualified person with proper management experience would be able to do more justice at the top than a non-technical person.

It is easy to understand that a non-technical man who is not able to understand the technicalities of new process, methods and equipment is bound to hesitate to depart from the established procedures and venture for new ideas. This is more so in the public sector than in the private sector since the whole administration of the public sector is on a bureaucratic pattern.

It is indisputable that in this technological age there are very few management decisions which do not involve technical considerations in one way or the other. There are some decisions, where technical considerations are vital. Those who are vested with the authority of making these decisions will not be able to arrive at the optimum ones, unless they possess the necessary technical background. A person at the helm of affairs without any technical knowledge or background cannot do full justice to his position. Therefore, the questions that arise are : how far should technical knowledge qualify a person for a high management responsibility, and to what extent are the management functions affected, either weakened or enriched, by too much technical background.

May be, the true answer to these questions lies somewhere between two opinions. What is probably needed today more than ever is the manager whose technical knowhow stops short of detail and who has, at a point in his career, opted for wider and broader horizons. However, one thing is certain, the manager must keep abreast, as far as possible, of technical aspects of merchandize or services or both for which he is responsible. Besides, it would be easier for an engineer to master general administration and other non-technical subjects than for a non-engineer to master technical subjects in a relatively short period. An engineer therefore with a wider horizon and a flare for leadership would definitely make a better business manager than a non-engineer.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Bihar Centre

Chairman's address by Shri S. N. Sinha, M.I.E., at the 18th Annual General Meeting of the Centre on February 7, 1965

After welcoming the Chief Guest, and other invitees, Shri S. N. Sinha thanked the Committee of the Centre for electing him Chairman for 1964-65.

Delivering the Chairman's address, he said,' Professionalism may be expressed as a 'way of life founded upon certain ideals of professional morality.' Few would dispute that the relationship between the 'professional' and the 'client' should be based on a purely objective assessment of one's work and application and the sense to serve a cause. This is the dominant idea in the concept of 'professionalism'. I mention this to stress the need not only to maintain a strictly professional attitude towards our work but also to resist firmly any temptation to relax this attitude. This is absolutely necessary in order to safeguard and improve the status and prestige of engineers in the modern society.

The importance of the Institution would be apparent in this context. It is not merely a forum for jointly voicing the general welfare of its members but its existence is necessary to maintain a constant watch on technological developments, inspire confidence among members of the profession, and guide them strictly according to the Code of Ethics, it has laid down. It is with a sense of pride that I say that the Institution and its members have been the main architects of the country's technological development and awakening but without in any way diverting from the paths of Code of Ethics.

It has therefore been a matter of considerable surprise and even resentment to learn that an important report, much in discussion in Bihar today, has thought it proper to make uncalled for and basically incorrect observations like, 'The shortage of engineering talent is temporary and accidental and Bihar Government is not a keen competitor for technologists.'

I have watched with great interest the activities of the Bihar Engineering Services Association. This Institution cannot ignore the burning problems of engineers employed in government service. The reported recommendations of the Pay Revision Committee, it appears, have rather highlighted the unfortunate bias towards the engineering profession. It is not only in respect of emoluments of engineers in government service, which, it is learnt, in certain categories, is sought to be reduced, while the intention and the decision were to increase the existing emoluments due to increased costs of living. Even far-reaching and pinching decisions are reported to have been envisaged for lowering even the existing status of engineers. I cannot help quoting from the speech of our late Prime Minister at a meeting of the Standing Committee of the National Development Council, New Delhi, in January 1956 :

'Much has been said about lack of technical personnel. I do not think there is going to be any real difficulty about technical personnel. We have able persons and there is no doubt that we can train them more. There may have been delay but we are starting to train them up. I go a little further and say that scientific and technical personnel should be introduced not only in the technical processes but in administration also. The administrator is an able man and does a good deal but his thinking is on different lines from that of a technical man. I think there should be a greater inclusion of the technical and scientific type of thinking in our administration. It is good to mix the pure administrator with the technical man and the scientific man. After all, all problems today are problems of science and technology. An able administrator or an able politician, just as an able lawyer, can grasp the broad outlines of a problem, but it is another thing to have grown up with all the processes. I think, therefore, scientists and technicians should be associated more and more with administration and planning.'

Prof. S. R. Mehra while delivering his Presidential Address to the Indian Roads Congress held in November 1964, mentioned : 'There seems to be a conviction in the minds of the present and past responsible personnel of the technical and scientific services, that they are being debarred from giving their best to the country, because of the present defective system. The general belief is steadily building up a resentment in the minds of the technical and scientific, which is good neither for the professions nor for the country.'

While one could appreciate an honest expression of opinion about such matters, it has to be accepted that the resentment which is mounting, rather rapidly, is not because there can be difference of opinion in interpreting a subject or a procedure, but because there is evidence of an attempt to bring about a situation in which the position and prestige of technicians, and more so of the engineers, are sought to be undermined to such an extent that they would not be able to play their dominant role in the development of the country. It has been said time and again that engineers are heirs to a great legacy. For the last 2000 years, engineers have been serving the society and the State and their efforts have helped the country's economic development, diffusion of its culture and and its resistance to foreign aggression. When Dr. K. L. Rao spoke in the Parliament in May 1962, he is reported to have said that, '......Therefore, irrespective of the considerations that prevailed in the past, it is essential, if we are to develop, if we are to achieve the prosperity of technological revolution, that technical organisations, technical bodies and technical ministries, whether at the Centre or at the State level, must be headed by engineers. Given trust, treated as equals, and fixed with responsibility, you will find that even under difficult conditions, there will be no difference between the targets and the achievements, when the engineer is told to do his work.'

The position has unfortunately been worsening. The impact of such a situation on the developing economy of the country is a matter of great concern. It is more so now, because it has been roughly estimated that two-thirds of the entire outlay on the development plan for the country is on works which have to be executed by engineers. The quality, the speed, the cost and the final product depend entirely on the effectiveness with which the engineers can play their pivotal role by eliminating all red-tape and bureaucratic plethora. It is well known that in the near past, in spite of handicaps, the engineers of the country have played their role and the progress achieved has been in a large measure due to them.

I would in a few words review what has been done in this State, not merely for custom's sake but to illustrate a few points. The State has to its credit river valley projects undertaken for irrigation and development of power potential. The Sone Barrage, the Gandak, Kosi and Tenughat projects are some of the important ones which are likely to change the face of Bihar. The progress achieved is a tribute to the engineers of the State. A number of water supply schemes have been executed in time.

In respect of road communication, the State is proud of remarkable achievements and has always kept up targets. During the Emergency, the engineers of the State raced with time to complete a 100-mile missing link in the Highway. The IDA Credit Programme, the Coal Roads and now the Lateral Roads, have all taken shape and the highways and bridges of the IDA Programme will be completed shortly. The agro-industrial development of the State will be greatly accelerated by the execution of these programmes.

The Centre has been, from its very inception, pioneering the cause of the construction of a bridge over the Ganga at Patna. It has been firm in its views that a bridge over the Ganga at Patna is most essential and had stood for the same even when consensus of opinion veered round Mokameh. It has, therefore, now followed with great interest the lead taken by the Government for the location of the bridge at Patna and feels sure that the dream for this bridge will soon be a reality. This bridge will be a landmark in the history of development of this State.

The engineer is a specialist. Every programme of development poses an engineering problem and it is but necessary that the views and advice of the specialist are not filtered, not even modulated and of course, not distorted in any way. The question then arises as to why one should deny the engineers, who have not only the scientific and technological but even analytical frame of mind, to manage, run and administer at least the technical departments, industries and projects. As our late Prime Minister said, 'It is another thing to have grown up with all the processes'. It is the engineers who have grown up with all the processes and all problems today are problems of science and technology.

It has to be accepted that the engineering of today is very different from the engineering of pre-independence days. There can be no two opinions that engineering works are getting involved and complex, and there has to be a change in the present system of engineering education and practical training so that the young men coming out can shoulder the responsibilities devolving on them. Dr. Khosla's advice is worth repetition here: 'An engineer's main responsibility is to produce results of best quality in a minimum time and at a minimum cost. An engineer has to be fully aware of the quality, time and cost factors and has therefore to be a planner, organizer, designer, builder and manager. Quality control, cost and time factors have to be carefully understood. Engineering, therefore, must have more of science content and education must be so imparted that the student is able to develop his creative potentiality. It is necessary for him to develop a sense of urgency and to realize that engineering is not a static but applied science.

Our engineering education today is based on the full understanding of its problems so that when on the one hand an engineering student gets more of science content, he also understands the changing phenomenon of applied science where design and research have to go hand in hand, and where relentless search has to be made for new techniques, new ideas, new processes and new criteria.

Engineering education is still being thought of as limited to the teaching institutions. It has, perhaps, yet to be realized that the domain of engineering employment should also be treated as educational institutions for engineering teaching. Practising engineers are as important teachers as those working in educational institutions. A concept, rightly or wrongly, continues to be held both by the universities and the government that practising engineers have nothing or little to do with engineering teaching. Dr. T. Sen, President of the Institution of Engineers (India), while delivering his Presidential Address, in 1963 had very rightly focussed the attention of all concerned to this aspect and had observed that practising engineers have an equally vital role to play as teachers. They have to perform the vital educational role of 'helping to transform young men who have been taught the basic principles of engineering and whose minds have been attuned to engineering, into real engineers'.

I therefore suggest that the undergraduate carriculum for engineering should be re-oriented to include more of science content and shaped to enable growth and stimulation of scientific and mathematical faculties. At the same time, an understanding of the applied nature of engineering science and the need for better collaboration between technical institutes and practising engineers must be brought about quickly and in an organized manner. Emphasis on post-graduate and research work has to be concerted and must not be casual for statistical purposes. Post-graduate teaching and research must improve and there should be long term and well defined programmes for carrying out research in the various large institutes imparting technical education. Applied research must hold the field since it is through constant endeavour that newer methods can be devised and utilized for producing results of the best quality in the minimum time and at minimum cost'.

Summaries of Papers Published in the Journal, vol. 45, no. 10, pts. EL 5, CH and PH 3, June 1965

ELECTRICAL ENGINEERING DIVISION

Limiting Transformer Noise

S. K. Goyal
Non-member

The problem of transformer noise or hum has attracted attention of research workers the world over. The large increase in the size of transformers in recent times has aggravated the problem of noise and vibration. Vibration caused by transformer hum is transmitted to structures in the vicinity and much damage may be caused to such structures if they form a resonant vibrating system. In this paper, the factors responsible for transformer hum are analyzed and the methods for limiting the noise in transformers are described.

Behaviour of a Rectifier Bridge Comparator as an Amplitude Comparator

T. S. Madhava Rao

Non-member

The rectifier bridge comparator is being increasingly used in the field of protective relaying as a static amplitude comparator. However, its behaviour in a static circuit has not been fully analyzed till now. This paper is an attempt to make such an analysis. As a result, the performance of the comparator has been correlated with the impedances of the polarized relay, the input sources, and the rectifiers.

Economics of Static Shunt Capacitors for Minimizing Distribution Loss

V. N. Rikh

Associate Member

A shunt capacitor minimizes system loss, improves voltage and stability conditions, and increases the effective capacity of an electrical plant. In this paper, the economics of a shunt capacitor installation is worked out considering its effect on the distribution loss in a straight distributor fed at one end only. In a distributor network, the sections beyond the capacitor installation do not carry the capacitor current; hence, each of these sections can be considered as a straight line joining the feeding point and the point of capacitor installation with the various loads lumped at the branching off points. A simple graphical method for solving practical cases comprising complex networks, which require lengthy calculations by the existing methods, is also given in this paper.

Transient Starting Currents in Three-Phase Induction Motor

Amarjit Singh

Non-member

Transients are present in the starting current of an induction motor. Under suitable circumstances, the transient currents may have several times the steady state values and prove detrimental to the motor. In this paper, an attempt is made to study the transient starting current in a three-phase squirrel cage induction motor. Theoretical analysis is made using the method of symmetrical components and the results are verified experimentally from the oscillographs of the starting current in a four-speed pole-changing induction motor.

CHEMICAL ENGINEERING DIVISION

Thermal Conductivity of Indian Thermal Insulating Materials at Medium Temperature

T. D. Bansal
Non-member

and

V. P. Wasan
Student

In this paper, data on the thermal conductivity of heat insulating materials, as compiled by the National Physical Laboratory, New Delhi, are given. A list containing conversion factors is also given to facilitate calculations by practising engineers in the field of thermal insulation engineering.

Human Factors in Interplanetary Flight

Prof. S. K. Nandi
Non-member

During a journey through space, human beings are subject to various formidable problems created by gravity, weightlessness, food, exposure to radiation, psychological reactions to solitude, etc. This paper briefly reviews the effects of these factors on a human being while on a space flight.

PUBLIC HEALTH ENGINEERING DIVISION

Evaluation of Laboratory Sand Filtration

A. K. Deb
Associate Member

and

Dr. L. B. Polkowski
Non-member

A set comprising three laboratory type rapid sand filtration units was used to measure the head loss in the different layers of a sand bed, when coagulated influent water having uniform suspension was let into it at different rates of flow using fine, medium and coarse media. An empirical relationship between the rate of change of head loss, the depth and the time was developed for the different layers of the sand bed. At the end of a run, the surface layers in the filters were agitated and the filter was put into operation again without washing; and more filtered water was obtained without deteriorating the quality of the effluent. This proves that surface agitation may be adopted in a water filtration plant to increase the duration of filter run.

Stream Capacity Constants of Adyar River

Dr. B. B. Sundaresan
Associate Member

Due to industralization and urbanization of the country, a greater volume of treated or partially treated sewage and industrial wastes are discharged into the natural water courses. For effective regulation of stream pollution, it is necessary to determine the stream cpacity constants for different rivers. This paper presents a study of the pollution of the Adyar River, Madras, and its capacity for self-purification. Sampling stations were established along a 8¾-mile stretch of the river and the quality of water based on chemical, bacteriologocal and biological analyses was determined weekly for about five months. Experimental data were used to evaluate the stream capacity constants, *e.g.*, deoxygenation, re-oxygenation, and B.O.D. deposition. The values of these constants were found to vary depending upon the conditions prevailing at the different sampling points along the course of the river.

Conditioning Tannery Waste for Biological Treatment

C. P. Thambiannan
Non-member
and
T. K. Meenakshisundaram
Non-member

The waste produced in a tanning industry which contains a large amount of soluble organic matter needs biological treatment before disposal into the stream. It is possible to draw the waste from the different stages of tanning, treat each waste separately by suitable methods and finally dispose the composite effluent into a sewer or stream. This paper presents a study of the effect of sewage in conditioning tannery wastes for biological treatment, undertaken by the Public Health Engineering Department of the College of Engineering, Guindy. Experiments were conducted for three months using two small-scale trickling filter units. The wastes were obtained from the vegetable tanning yard of the Central Leather Research Institute, Madras, and the sewage from the pumping station in the college campus. The results of the experiment are also given.

INSTITUTION NOTICES

Draft Indian Standards

1. Draft Amendment No. 1 to I.S.: 1570-1961 Schedule for Wrought Steels for General Engineering Purposes, Doc :SMDC 19(672).

Members may send their comments on the above Standard before August 1, 1965, to Dr. G. P. Chatterjee (*M.*), Chief Metallurgist, Durgapur Steel Project, Durgapur 3, who is the Institution representative on the Sectional Committee dealing with this Standard.

2. Draft Indian Standard Method of Sampling and Testing Clay Building Bricks, Doc : BDC 30(915).

This Standard covers the methods of sampling and testing solid and perforated clay bricks.

Members may send their comments on this Standard before August 4, 1965, to G. T. Gokhale (*M.*), Nirbhaya, 1961 Sadashivpeth, Hanumanbag Vasahat, Poona 5, who is the Institution representative on the Sectional Committee dealing with this Standard.

Copies of the draft Standards may be obtained from the office of the Indian Standard Institution, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 1, or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay 1 ; 11 Sooterkin Street, 3rd Floor, Calcutta 13 ; 14/69 Civil Lines, Kanpur ; or 1/12 First Line Beach, Madras 1.

Guest Rooms at the Mysore Centre, Bangalore

Guest Rooms at the premises of the Mysore Centre building are now ready duly furnished. Four double-rooms with two costs in each room are available for occupation by visiting members.

Members of the Institution from the moffusil and their families are welcome to stay during their visit to Bangalore. The scheduled charges are Rs. 6.00 per person or Rs. 10.00 for two persons in one room.

Members desrious of staying in the Guest Rooms are requested to write to the Honorary Secretary, The Institution of Engineers (India), Mysore Centre, No. 3 Vidhana Veedhi, Bangalore 1, well in advance of their arrival giving full details of the number of persons staying, duration of stay, etc. and obtain from him confirmation in regard to the desired reservation.

No boarding facility is available. Morning tea can be had and this will be charged extra.

Statistics of Corporate Members interested in Structural Engineering

The Council has desired collection of statistics of Corporate Members specially interested in the field of Structural Engineering, with a view to assess the possibility of upgrading the Concrete Construction and the Domes, Plates and Shells Groups together to the status of a Division.

Attachment to the Division, if formed, will be open to Corporate Members and Graduates (Students are not classified under the Divisions of Engineering specified under Bye-Law 7). Bye-Law 10 which governs such attachment reads :

> 'Corporate Members and Graduates shall be attached to one Division only based on their educational qualifications approved by the Council at the time of their admission to the Institution, but if so qualified for attachment to more than one Division, a Corporate Member and a Graduate shall be allowed to select

and change to the Division to which he would like to be attached. The Council may, however, at their discretion, allow the transfer of a Corporate Member or Graduate from one Division to another provided he establishes to their satisfaction that he deserves such transfer on account of change in the field of his practice of engineering subsequent to his election as a Corporate Member or Graduate. Corporate Members and Graduates may take part in the technical activities of one or more Divisions other than their own in accordance with rules, made from time to time by the Council'.

Corporate Members and Graduates are therefore now classified so that *they are attached to only one Division*, and only one Division is shown against each name in the Year-Book.

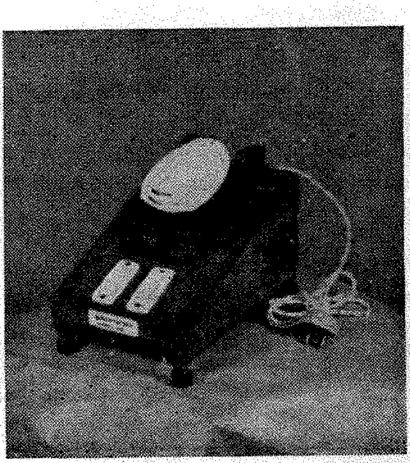
This means that those who desire to be attached to a Division other than the one to which they are presently attached, will be detached from the Division to which they are attached now and attached to the Division desired by them, provided they are so qualified under Bye-Law 10. Where a Corporate Member or Graduate desires to be attached to a Division other than the Division to which he would be attached by virtue of his educational qualification at the time of his admission to the Institution, his request will be placed before the Council in terms of the same Bye-Law for consideration.

In order to assess the strength of Corporate Members who are primarily interested in the field of Structural Engineering and support upgrading of the two Groups, *viz.*, Concrete Construction, and Domes, Plates and Shells, together to the status of a Division and desire to be attached to such a Division if formed, a census is now being taken through the requisition card attached to this *Bulletin*. As this is the only satisfactory means of ascertaining the representative strength of such Corporate Members, they are requested to return the card, complete in all respects, not later than August 31, 1965.

INSTITUTION NEWS

New type of burglar alarm

An original device to function as a burglar alarm has been invented and built by a member of the Institution, Shri Harbans Raj (*Affiliate Member*), which has a wide field of obvious applications, specially in cases of intrusion, theft, etc. It is claimed to be first of such invention in this country, and enquiries addressed to this office will be forwarded to the member. A photo of the equipment is given alongside.



Donation by members to Headquarters Building Fund

A list of members who have contributed to the Fund as on May 31, 1965, since the publication of the last list given in the *Bulletin* dated April 1965 appears below. These donations are gratefully acknowledged.

Member		Donation
Shri B. Sengupta (*Student*)	..	3.00
Shri B. K. Saxena (*Student*)	..	5.00
Shri G. C. Sekhar Rao (*Student*)	..	11.00
Shri K. Balaraman (*Student*)	..	5.00
Shri P. Sundara Rao (*Student*)	..	5.00
Shri H. B. Singh (*Student*)	..	15.00
Shri M. P. Venkateswaran (*Student*)	..	10.00
Shri H. K. Sharma (*Student*)	..	5.00
Shri S. S. Mahajan (*Student*)	..	5.00
Shri G. R. Varadarajan (*Student*)	..	5.00
Shri C. B. Kulkarni (*Student*)	..	5.00

Short Course in Public Health Engineering with Special Reference to Drainage, Indian Institute of Technology, Kharagpur, November 24-December 4, 1965

A short course in Public Health Engineering with Special Reference to the Drainage Problem will be held from November 24 to December 4, 1965, at the Indian Institute of Technology, Kharagpur. The aim of the course is to provide the essential background to the modern developments in the subject and is open to teachers as well as practising engineers. A fee of Rs. 50 per participant will be charged.

Further details can be obtained from Prof. B. B. Bhattacharyya, Civil Engineering Department, Indian Institute of Technology, Kharagpur.

Proceedings of the Second Congress of the International Federation of Automatic Control, Basle, 1963

The Second Congress of the International Federation of Automatic Control (IFAC) was held in Basle, Switzerland, in 1963. Nearly 210 participants from 31 countries throughout the world presented papers on the theoretical and practical aspects of the subject with special attention to the most recent advances in each field. The Russian papers have been translated into English.

The *Proceedings* are divided into two volumes.

Volume 1 entitled 'Applications and Components' contains papers describing applications in the electrical utility field, the steel industry, the chemical and oil industries, automation in industrial processes, combined man-machine systems, automatic control of aerospace systems and the report of the Chairman of the IFAC Technical Committee on Applications; and the components in mechanical, hydraulic and preumatic devices, electromechanical devices and magnetic amplifiers, electronic components, digital devices, process instrumentation, component reliability, and the reports of the Chairman and the Vice-Chairman of the IFAC Technical Committee on Components.

Volume 2 entitled 'Theory' contains papers describing function techniques, prediction systems, nonlinear systems with random parameters, nonlinear stochastic systems, discrete systems, sampled data systems, relay systems, theory of finite automata, optimal systems, and theory of self-adjusting systems.

A set of the *Proceedings* is priced at £38 and is available from Butterworth and Co. (Publishers) Ltd., 88 Kingsway, London, W.C. 2.

FORTHCOMING CONFERENCES

Seminar on 'Zinc Wastes and Their Utilization', Calcutta, September 1965

A Seminar on 'Zinc Wastes and Their Utilization' will be held in Calcutta in the first week of September 1965. The purpose of this Seminar is to bring together technical personnel from galvanizing and metal reclaiming industries, research organizations, and technical institutions to review the subject and to exchange ideas on the effective utilization of zinc wastes under Indian conditions.

Further details can be obtained from the Indian Hot Dip Galvanizers Association, 5A Lord Sinha Road, Calcutta 16.

38th Annual Conference of the Water Pollution Control Federation, Atlantic City, October 10-14, 1965

The 38th Annual Conference of the Water Pollution Control Federation will be held in Atlantic City, New Jersey, U.S.A., from October 10 to 14, 1965. The highlights of the technical programme include discussion on : (i) The Growing Problem of Lake Eutrophication, (ii) Industrial Waste Treatment Success Stories, (iii) Wastewater Reclamation and Re-use, (iv) Management, Safety, and Public Relations, (v) Industrial Waste Forum, (vi) Sludge Concentration—Methods and Experience, (vii) Collection System Design, (viii) Collection System Operation and Maintenance, (ix) Water Quality Management—Pollution Investigations, (x) In-Plant Investigations, (xi) Application Research to Design, (xii) Frontiers of Industrial Waste Treatment, and (xiii) Operator's Forum.

Four half-day sessions will be devoted to present and discuss over 20 papers covering the latest water pollution control research. Among the subjects from which papers will be chosen are : activated sludge; algae problems ; anaerobic digestion ; chemical treatment ; several methods of advanced waste treatment such as carbon filtration, evaporation, foam fractionation, ion exchange, reverse osmosis, and solvent extraction; estuarial and oceanographic problems; excess nutrients from treated waste water; oxygen transfer; sludge concentration ; solids separation ; pesticides ; subsoil disposal of waste water ; and system analysis.

Further details can be obtained from the Water Pollution Control Federation, 3900 Wisconsin Avenue, Washington, D.C. 20016, U.S.A.

Symposium on Automatic Control in Electricity Supply, Manchester, March 29-31, 1966

A Symposium on 'Automatic Control in Electricity Supply' is being arranged under the aegis of the United Kingdom Automation Council, at Manchester from March 29 to 31, 1966.

The aim of the Symposium is to present and discuss the most recent experiences in operation and practical design of automatic control in the supply of electric power, and to express views and expectations on the possible future trends. It is intended to hold also an exhibition of suitable equipment and arrange organized visits to power station plants and to manufacturers' works.

Its scope includes :

(i) Automatic control in transmission and distribution supply networks (automatic switching and automatic loading) ;

(ii) Automatic control in generating stations (starting up and shutting down) ; control of running plant under steady-state and fault conditions ; and optimization of efficiency in the running of a power station ; and

(iii) Kindred problems and future trends.

Further details concerning the Symposium and Registration Forms will be available a few weeks before the Symposium from Dr. R. Feinberg, Transformer Division, Ferranti Limited, Hollinwood Avenue, Chadderton, Lancs, U.K.

1966 British Joint Computer Conference, Eastbourne, May 3-5, 1966

The 1966 British Joint Computer Conference will be held at the Congress Theatre, Eastbourne, Sussex, from May 3 to 5, 1966. The Organizing Committee has provisionally agreed on the following topics for inclusion in the Conference programme :

Scientific applications

- Combinational problems, *e.g.*, scheduling, assignment and timetabling
- Use of computers for engineering design

Management planning and decision making

- Resource utilization
- Network analysis
- Business control at all levels (including production control)

Current problems

- The interation between the design of computer system (hardware/software) and the needs of the user
- How the systems engineer proposes to meet the requirements of the user
- How the user proposes to accommodate the limitations of the system

Engineering of real time system

Future horizons

Contributions of up to 3,000 words are invited for inclusion in the programme. Those wishing to offer material should send a brief synopsis of their proposed contribution to the Conference Secretariat, The Institution of Electrical Engineers, Savoy Place, London, W.C. 2, by July 31, 1965.

Fifth Congress of Federation Internationale de la Precontrainte, Paris, June 11-18, 1966

Further to the announcements made in the *Bulletin* dated July 1963, additional information received from the FIP Administration Office is given below.

There will be reports on the work of the F.I.P. since the Rome Congress in 1962, and also on the work of its commission on the following subjects : International Code of Practice for Prestressed Concrete ; prefabrication ; prestressed concrete structures in earthquake regions ; high-strength concrete ; prestressed light-weight concrete ; application of prestressed concrete to machinery structures ; fire resistance of prestressed concrete fuel oils and petrol tanks. In addition, the programme of work for the following years will be formulated during the Congress.

Simultaneous translations will be provided in the four official languages, English, French, German and Russian ; and documents, paper and proceedings of the Congress will be published in each of these languages. A number of excursions and receptions have been organized, and a special programme has also been arranged for ladies accompanying Congress participants.

Those who wish to attend the Congress, and to receive further details when they become available, should notify Madame Favier, General Secretariat of the Fifth International Congress on Prestressed Concrete, Societe d'Organization des Congress Francais et Internationaux (S.O.C.F. & I.) 1 ter, rue Chanez, Paris 16 e, France.

Third International Heat Transfer Conference, Chicago, August 8-12, 1966

The Third International Heat Transfer Conference will be held in Chicago from August 8 to 12, 1966. The Conference is being arranged jointly by The American Institute of Chemical Engineers, The American Society of Mechanical Engineers; and The Institution of Chemical Engineers and The Institution of Mechanical Engineers, U.K.

Papers are being sought on the broadest possible basis in both fundamental and applied aspects of heat transfer and accompanying mass transfer. Abstracts of proposed papers should be sent to Mr. R. J. Millson, The Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W. 1, not later than July 1, 1965. Authors will be notified by August 1, whether or not abstracts have been accepted and final manuscripts, in English, will be required by November 1, 1965, and will undergo the normal refereeing procedure.

Further information can be obtained from Mr. H. Umpleby, Information Officer, The Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London, S.W. 1.

BOOK ACKNOWLEDGMENTS

1. **Bridge Engineering.** J. S. Alagia. *Charotar Book Stall,* Anand. Rs. 7.50, 5th edition, 1965. 202 pages.

In this book, elements of bridge engineering as prescribed in the syllabi of Indian universities are dealt with. Various types of bridges and their component parts are illustrated, and the design, construction and maintenance aspects of bridges are described. In this edition, the metric system of units are used side by side with the British units.

2. **Estimating and costing.** S. C. Rangwala. *Charotar Book Stall,* Anand. Rs. 12.50, 1st edition, 1965. 208 pages.

This book covers the syllabus prescribed for students preparing for the degree and diploma examinations in engineering. It gives estimates of typical engineering structures. Metric units are used throughout the book.

3. **Compendium of Words and Phrases Used in Building Contracts.** B. D. Virmani. *Engineering Law Publications of India,* Lucknow. Rs. 12.50, 1965. 219 pages.

Building and engineering contracts involve several inexatitudes which have to be interpreted according to drawings, specifications, etc. Building owners, engineers, architects, quantity surveyors, inspectors of works and others connected with the building industry should know the implications of buildings contracts. This book gives the common phraseology in this field and serves as a practical guide.

4. **Principles and Practice of Planning Villages—Part 2.** Construction Practice in Rural Areas. J. Jahne. *Asia Publishing House,* Rs. 5.25, 1964. 106 pages.

In the Technical Fundamental Series, several books on planning, construction and architecture of villages and the installation and facilities needed in village planning have been described. In this book, the author not only deals with the construction of new buildings, but gives suggestions as to how existing buildings can be adapted to new conditions and reconstructed by rational methods.

5. **Heat Engines and Applied Thermodynamics.** N. C. Dey. *Asia Publishing House,* 1964, Rs. 26.00. 443 pages.

In this book, the author describes the modern trends and developments in the generation of steam, and steam oil and air engines and motors, both from the theoretical and practical points of view. Besides dealing with the theory of heat engines, the book provides descriptions of boilers and boiler mountings and accessories. Some original analysis is made in the sections dealing with combustion and air motors. Extracts from the Indian Boiler Rules are given. A number of worked examples (using the metric system) are given at the end. Conversion tables (from F.P.S. to M.K.S.) for thermodynamic constants are also contained in the book.

6. **Automobile Engineering.** S. Herrmann. *Asia Publishing House,* Rs. 6.00, 1964. 151 pages.

This book has been written for motorists who are permanently on the road and are frequently left to their own resources. The working, construction and performance of the various components of the motor car are described. Numerous practical directions for remedying troubles that may suddenly occur are given in a tabulater form. However, major repairs have to be performed in workshops staffed with skilled personnel and equiped with single-purpose tools.

7. **The Fundamentals of Gas Welding—Part 1.** F. Wettke. *Asia Publishing House*, Rs. 8.00, 1964. 101 pages.

The first part of this book in the Technical Fundamental Series deals with the most commonly used gas generators, welding and cutting torches, pressure reducers and auxiliary equipment, and special knowledge is not required on the part of the reader. Special attention is focussed on skilled handling of equipment, giving due consideration to the prevention of accidents. Common faults and their possible causes and remedies (to the extent a welder should and is allowed to carryout repairs) are discussed.

8. **A Text-book of Practical Chemistry for Engineering Students.** R. Paul. *Parkash Bros.*, Ludhiana, Rs. 4.00, 1965. 252 pages.

This book covers the syllabi for applied chemistry (practical) of the Punjab State Board of Technical Education and the U.P. Board of Technial Education.

9. **Technical Tables.** E. Grytz. *Asia Publishing House*, Rs. 10.25, 1964. 295 pages.

Books of technical tables are intended for facilitating computational, design and practical work involved in all fields of industrial and handicrafts production. This book of tables has been compiled on the basis of experience gained during several years. Beginning with elementary calculations, the final section of the book gives mathematical tables and the fundamental principles which are required in industrial and handicrafts production. The book also contains physico-technical tables which are helpful especially in machine building, electrical engineering and construction practice. Further sections of the book are devoted to special tables of values from the fields of electrical engineering and chemical industry. The book also gives a survey of constructional materials, and the most commonly used standards in industrial countries.

10. **English for Engineering Students.** G. V. L. N. Sharma. *Asia Publishing House*, Rs. 8.00, 1965. 235 pages.

This book, designed to offer engineers a basic knowledge of the use of the English language, is suitable as a refresher study course. It deals with the aspects of punctuation, style, spelling, general modern usage, letter-writing, epitomisation, essay writing and drafting of technical reports, and is written with particular regard to the needs of the students of today and contains exercises with technical bias.

PUBLICATIONS RECEIVED

A copy of the 106th Anniversary Number of 'The Indian and Eastern Engineer' has been received. This special number contains several illustrated articles by eminent authors in their field of choice.

A copy of the publication entitled 'The Production and Use of Purer Alcohol in Asia and the Far-East' has been received. This publication contains the report of a seminar held at Lucknow in October-November 1952, organized by the Technical Assistance Administration and the Economic Commission for Asia and the Far-East of the United Nations.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organisations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column, a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

MECHANICAL ENGINEER, B.E., A.M.I.E., 34, six years' experience in heavy manufacturing repair and operational industries (electrical and mechanical), further six years experience in engineering research. Specialises in (i) instrumentation for dynamic testing and experimental stress analysis, (ii) design, fabrication and installation of mechanical and heat-power test beds or mobile laboratories, (iii) training personnel in the use of modern transducers, electronic instruments and recording devices for research purposes. At present a substantive Class I Officer in the Ministry of Railways, would be available for fresh engagement by the middle of August 1965. Is interested in organising research laboratories in connection with design, development or teaching engineering technology for the undergraduate and postgraduate courses. Is also interested in assuming consultative responsibility in planning and development projects for improvement of homecrafts and rural economy. (Office ref. E.S. 197)

FIRST CLASS YOUNG CIVIL ENGINEERING GRADUATE, A.M.I.E., age 27 years, having 5 years experience in design and drawing office, seeks a suitable change in Bombay. Salary about Rs. 500. (Office ref. E.S. 198)

MECHANICAL ENGINEER, L.M.E., Grad. I.E., Associate Member of the Society of Power Engineers (India), 36 years old, with 14 years experience in operation and maintenance of modern steam power plants and industrial service plants of textile and chemical industries, knowing Hindi, Telugu and Tamil languages, seeks a suitable change for better prospects in any reputed concern in senior position such as Power House Superintendent, Maintenance Engineer, Works Engineer, etc. Available for appointment from September 1, 1965. Salary expected Rs. 1,100 p.m. (Office ref. E.S. 199)

THE INSTITUTION, ITS LOCAL CENTRES AND SUB-CENTRES

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P.O. Box No. 669

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Local Centres

Andhra Pradesh	Khairatabad, Hyderabad-4 *(Telephone 33066).*
Assam	P.W.D. Secretariat (R & B), Shillong.
Bengal	8 Gokhale Road, Calcutta-20 *(Telephone 47-2744).*
Bihar	Hardinge Road, Patna 1 *(Telephone 2-2639).*
Bombay	Ilaco House, Sir Pherozeshah Mehta Road, Bombay 1 *(Telephone 26-3430).*
Delhi	Bahadur Shah Zafar Marg, (near Tilak Bridge), New Delhi *(Telephone 27-2702).*
Gujarat	Law College Road, Ahmedabad 6 *(Telephone 78915).*
Jammu & Kashmir	C/o Divisional Engineer, Construction Division 1, P.W.D., Srinagar.
Kerala	Observatory Hill, Trivandrum-1 *(Telephone 2663).*
Madhya Pradesh	Royal Hotel Premises, Civil Lines, Jabalpur *(Telephone 1037).*
Madras	No. 1, Adam's Road, Chepauk, Madras 5 *(Telephone 85879).*
Mysore	No. 3 Vidhana Veedhi, Bangalore-1 *(Telephone 25471).*
Nagpur	North Ambazari Road, Nagpur-1 *(Telephone 5671).*
Orissa	Sachivalaya Marg, Unit IV, Bhubaneswar-1.
Poona	1332 Shivajinagar, Jangli Maharaj Road, Near Shivajinagar Post Office, Poona-5 *(Telephone 57377).*
Punjab	Sector 19A, Chandigarh *(Telephone 418).*
Rajasthan	C-46 Sarojini Marg, C Scheme, Jaipur *(Telephone 3327).*
Uttar Pradesh	River Bank Colony, Lucknow *(Telephone 25322).*

Sub-Centres

Allahabad	Allahabad Polytechnic, Allahabad.
Baroda	C/o Faculty of Technology and Engineering, M.S. University, Baroda 1, Gujarat State *(Telephone 4900).*
Bhilai	Works Office Building No. 3, Bhilai Steel Works, Bhilai, Madhya Pradesh.
Bhopal	C/o Transformer Engineering Department, Heavy Electricals (India) Ltd., Piplani P.O., Bhopal *(Telephone 1791 (City).*
Dhanbad	C/o Prof. M. S. Pai, P.O. Indian School of Mines, District Dhanbad, Bihar.
Durgapur	C/o Deputy Chief Engineer (Civil), The Durgapur Projects Ltd., P.O. Durgapur-2, District Burdwan, West Bengal *(Telephone DGP-24).*
Jammu	C/o Office the Superintending Engineer, Electric Project and Planning Circle, Jammu, Tawi.
Jamshedpur	General Engineering Division, TELCO, Jamshedpur-4 *(Telephone 612/57).*
Kharagpur	C/o Department of Metallurgical Engineering, Indian Institute of Technology, Kharagpur, West Bengal.
Nagarjunasagar	P.O. Hill Colony, Vijayapuri North, Nalgonda District, Andhra Pradesh.
Neyveli	Central Technical Office, Block 1, Neyveli 1, Madras State *(Telephone 2361).*
Ranchi	C/o Electrical Executive Engineer, Ranchi Electrical Supply Division, Old Secretariat Building, Doranda, P.O. Hinoo, District Ranchi.
Roorkee	C/o University of Roorkee, Roorkee.
Rourkela	C/o Department of Electrical Engineering, Regional Engineering College, Rourkela-8.

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STUDENTS INTENDING TO APPEAR IN NOVEMBER 1965 ASSOCIATE MEMBERSHIP EXAMINATIONS, PLEASE SEE NOTICE ON PAGE 23 AND APPLICATION FORMS, ETC. AT THE END OF THIS BULLETIN

BULLETIN OF
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Vol. 14, No. 11, JULY 1965

Supplement to the *Journal of the Institution of Engineers (India)*,
Vol. 45, No. 11, July 1965

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Biography of General Sir Arthur Cotton

A biography of General Sir Arthur Cotton, who has been called the 'Father of Irrigation' in Southern India, written by his daughter, Lady Hope, was first published in 1900 in England. This biography has now been reprinted by this Institution in homage to the memory of one of the greatest engineers of the last century who has been responsible for the prosperity of extensive areas in South India and as a source of inspiration to coming generations of India's engineers. This decision to reprint the book was an outcome of the celebration by the Andhra Pradesh Centre of this Institution on 25th August, 1959, on the passing of the first hundred years from the completion of the Godavari and Krishna river irrigation projects in 1859, and in that function, the present Union Minister for Irrigation and Power, Dr. K. L. Rao, who was then the President of this Institution, said that they were paying homage to the memory of one of the greatest engineers of the last century.

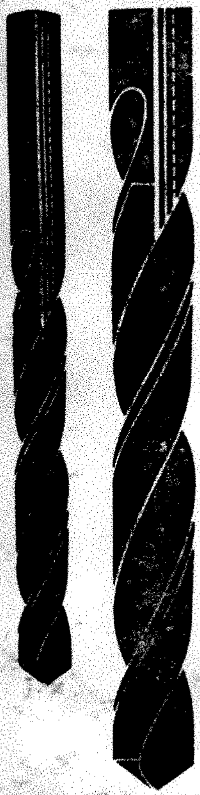
The cost of this book is Rs. 20 plus forwarding charges. Orders may kindly be sent to the Technical Officer (Scientific) at the address of the Institution.

New Telephone Numbers of the Institution

Consequent upon the installation of a new PBX telephone board, the exchange number of the Institution has changed from 47-4344, 45, 46 (3 lines) to 47-3362, 63, 64, 65 (4 lines). The line having the number 47-7370, so far a direct line, no longer exists.

The new installation does not, however, effect any change in the exchange number of the Examinations Department. That is to say, all calls meant for the Examinations Department will continue to be attended by 47-2034.

The change may please be noted for future guidance.



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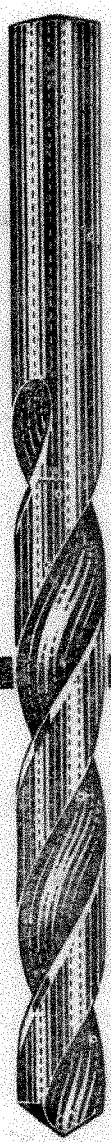

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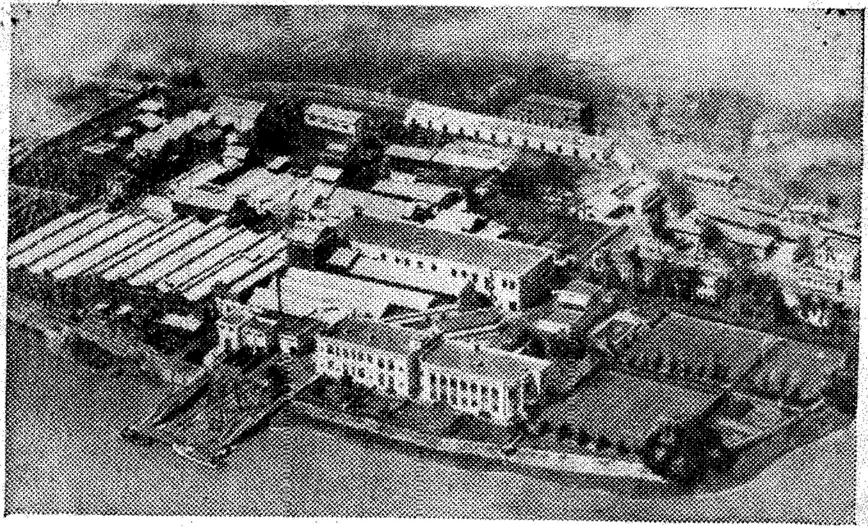

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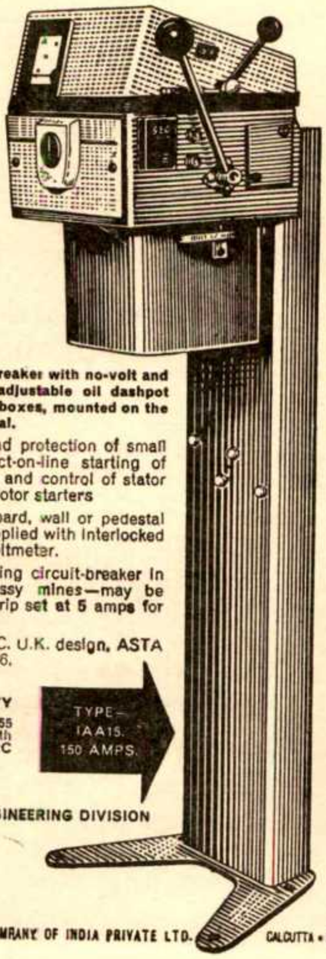

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DIRECT TRANSFORMATION OF HEAT INTO KILOWATTS BY THE MAGNETO-FLAME GENERATOR

Pierre Devaux

Non-member

For many years, engineers have been attracted by a fascinating problem. It is to eliminate the cumbersome machinery of the power houses by carrying out the direct conversion of heat into electricity.

Instead of the long series of machinery consisting of furnace, boiler, superheaters, three sets of turbines, condenser and electric generator, there would simply be an 'electrogene flame', a generating source of kilowatts. Such technical elegance...... and such economy !

To confine ourselves to running costs, our present power houses are built to last a quarter of a century only, so that after 25 years, billions will go to waste.

The problem, which had been quite fantastic, has now actually been solved in the laboratory. The principle is known. It is being tested in 'half-size' at Ruel, with the financial backing of the Institute Francais des Petroles and the Atomic Energy Commission. It will be tried out at the new Renardiere testing stand by Electricite de France, whose plant is to be the most powerful in Europe.

This very recent triumph bears a short name, consisting of three initial letters, MHD, standing for magneto-hydro dynamic generator—a title in which water particularly (the prefix hydro) seems irrelevant. Rather it is interesting to see how the miracle comes about.

A flame, a magnet......and that is all

Everyone knows today that electricity can move about in vacuum without a material conductor, in the form of invisible particles of negative electricity, the electrons. That is what occurs in a radio valve or in a X-ray tube.

Instead of electrons, 'ions' or electrified atoms can be projected. The amount of electricity then involved becomes very considerable. Such is the case with mercury vapour rectifiers or 'mutators', which receive alternating current and supply in exchange, continuous I, 500-volt current to feed the French railways.

All these ions, which move in the mutator with a violet glow, could surely be driven mechanically or by fire, to obtain current at the outside plugs.

The idea is all the more natural......in that it has already been applied in quite similar form in the famous dust generator by which fantastically high tensions of several million volts have been obtained in electrotechnical and atomistic laboratories. With a voltage not quite so high and power a little greater, we have the new MHD flame generator.

Imagine—and this is figurative—a flame of gas spurting out between the jaws of a magnet. On each side, touch the flame with two conductor plates connected with two plugs. From these plugs, you will collect electric current : you will have built a fire pilo !

Tests at Rueil-Malmaison

Let us describe the MHD generator that has been running and has been cautiously installed underground for fear of explosion, at the Rueil-Malmaison Centre.

Here the magnet becomes an enormous electromagnet, supplied by the Atomic Energy Commission and providing between its jaws a magnetic field of 17,000 gauss. That is a large figure, far more than exists in the slim air-gap of dynamos.

Across the magnetic field spurts with a roar a terrific flame of oil products at a speed of 700 m. per sec. In other words, the speed of the gases composing this flame is equal to that of a rifle bullet. The flame is super-excited with oxygen and 'sown' at the base with a small amount (1%) of potassium or caesium.

The atoms of these 'alkaline metals' electrify spontaneously at the high temperature of the flame (2,500°), transforming into negative ions.

Here the magnetic field comes into play. It deviates the ions which hit a graphite side plate and this then becomes the negative pole of the generator. The positive pole is to the ground of the nozzle. Where does the power come from that supplies this current? Precisely, from the thrust of the gases driving the ions, so ultimately from the thermal power of the flame : and so the problem is solved. ......But rather meagrely, it must be confessed, at present with regard to output. At Rueil, this does not exceed 1.5 per thousand, which is absurdly low. However, things are as yet at the experimental stage.

How is it possible then to anticipate that by the new process, it may be possible to send the production of the power houses, which is 40% at the most at the present time, up to about 55%? Simply because the magneto-flame generator will not be running on its own, the extremely hot gases coming out of the plant will be used to heat a boiler feeding turbines, following the conventional cycle. MHD production will be an 'extra'.

For physicists, one may say that a hot source with an extra-ordinarily high temperature will be available, allowing for an increase in output, in accordance with 'Carnot's Second Theorem'.

A fine ..... distant future

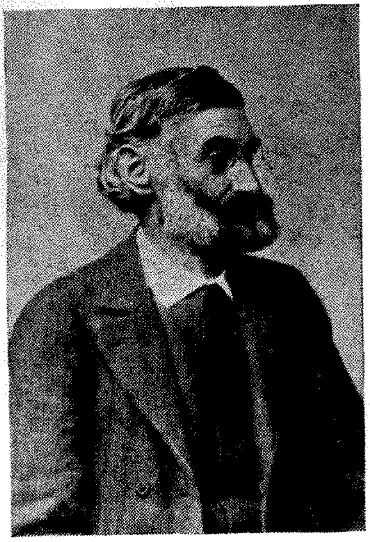
There are, of course, many practical problems still to be solved. The current produced by the MHD is supplied in an inconvenient form : a very low tension continuous current, which could only be used directly in the electrometallurgical or electrochemical industry.

Some means will also have to be found to recover the ionizable alkaline metal, potassium, for instance, which cannot be just let off as waste into the atmosphere. A variation of the process, based on the use of caesium, makes it possible to work in a closed circuit, in a current of rare gas, helium or argon. The running temperature can then be lowered considerably and then the atomic piles (nuclear reactors) can be used as a source of heat.

The Rueil prototype supplies only 5 kW of electricity. But at Renardieres, Electricite de France and Compagnie Generale d'Electricite have already set up a 10,000 'thermic kilowatt' generator. We conform here with the general habit of expressing the output of heat not in calories but in kilowatts, transformaton being assumed to operate 100%. If production by the Renardieres plant does not exceed that of the Rueil generator, the power obtained would amount to 150 kW; but the production will certainly be much higher and may come into a quasi-industrial scale.

With regard to 'operational' composite power stations, it is considered that they will not pay unless very high electric power is involved, above 500 MW (500,000 kW). But today 600 MW groups are being built, one two-group power-station producing 1,200,000 kW. We are entering, to recall the expression by the great Carnot, the age of the 'driving power of fire'.

ERNST ABBE, GERMAN PHYSICIST



On January 23, 1965, the workers, employees, scientists and engineers of VEB Carl Zeiss Jena commemorated in Eisenach, the 125th birthday of Ernst Abbe (1840), who died in Jena on January 14, 1905. In 1866, Ernst Abbe, Professor of Physics and Mathematics at the Jena University, entered the Optical Workshops of Carl Zeiss established in 1846, in the capacity of a scientific cooperator. He had set himself the task of placing the construction of the microscopes on a scientific footing in order to get away from the fortuities and inaccuracies of trial-and-error in empirical manufacture. In years of computational work, he elaborated the Abbe-Sine-condition for objectives of wide angular aperture, thus establishing the theory of diffraction of optical image-formation of non-selfluminous objects in the microscope, which is equally well applicable in many other optical instruments; and he then proceeded with the designing of new microscope objectives. In conjunction with this, Abbe developed a series of new instruments for testing and inspecting purposes such as the 'focimeter' for measuring the focal length, and the 'Abbe refractometer' for measuring the refractive index of liquid and solid substances. Long before his designing of the new microscope objectives, Abbe's name became known throughout the world by his design of the Abbe substage, a wide-aperture condenser with a displaceable iris diaphragm variable in size.

Appreciating that the materialization of theoretically computed optics was bound to remain a patchwork until one succeeded in melting new kinds of optical glass, Abbe found and won over Dr. Otto Schott, a scientifically-minded glass chemist, who in cooperation with Abbe, succeeded in placing glass-engineering on a scientific basis and creating new optical glasses (by the addition of lithium, phosphorus and boron). With the aid of these new glasses, Abbe was placed into a position where he could construct new objectives, such as, for instance, the 'Apochromat', which has become a concept the world over. Nearly 17 years of research and computation on the part of Abbe converted the new Zeiss microscope into an instrument which commenced on a triumphal tour throughout the world. Without Abbe's scientific performance, the great progress the world witnessed at the turn of the 19th century in the provinces of bacteriology, biology and medicine would not have been possible.

Dr. Robert Koch, the discoverer of the anthrax, cholera and tubercle bacilli, and the investigator of malaria and sleeping sickness, wrote 1904, that 'he owed a great part of his success to the excellency of the microscopes of Jena'. Not very long afterwards, the new Zeiss microscopes formed part of the equipment of laboratories and test and inspection rooms of industrial enterprises for the examination and inspection of raw materials as well as semi-finished and final products.

Abbe's title, as the Founder of modern optics, reposes on the following of his achievements : foundation of the theory of microscopic image-formation ; foundation of geometrical optics ; establishment of the theory of light-intensity in optical instruments, and the theory of the optical path ; and contributions to the theory of imaging aberrations.

As the inventor of outstanding mechanical and optical designs and inventions (reflectometer, refractometer, spectrometer, photometer, telemeter and optical comparator), he became the reformer of applied and technical optics. All modern precision-mechano-optical industrial enterprises throughout the world are indebted to Ernst Abbe for introducing the systematic coordination of science and technical art in the province of optical instrument building. Ever since Ernst Abbe's work, the opto-scientific and physico-technical instruments of the Jena Zeiss Works constitute the results and products of a wide-basis and very intensive research effort in the field of foundations-study in applied research as well as in the engineering and technology of production. Since Abbe the entire research and working activity of the Jena Works has been determined by the sciences of physics, astronomy, mathematics, chemistry, mineralogy, biology and medicine.

In the first 18 years since the Zeiss Work's Centenary in 1946, the VEB Carl Zeiss Jena—under the new sociological conditions of the German Democratic Republic—has not only upheld and cultivated the century-old Zeiss standard for quality and performance, but has succeeded furthermore in honoring the legacies of Carl Zeiss and Ernst Abbe by new and outstanding achievements in scientific research, development and the production of new Zeiss instruments, furthering the advancement of science, engineering and culture.

Ernst Abbe will thus be honoured as an eminent scientific investigator and prominent humanitarian, as well as a passionate friend of freedom and progress, and as the Founder of the Carl-Zeiss Stiftung Jena.

EXPO SHORT SPAN BRIDGE CONTEST HELD BY CANADIAN CORPORATION FOR THE 1967 WORLD EXHIBITION

The Universal and International Exhibition of 1967 sponsored a Short Span Bridge contest recently. One hundred and fifty-seven entries were submitted from professional engineers across Canada.

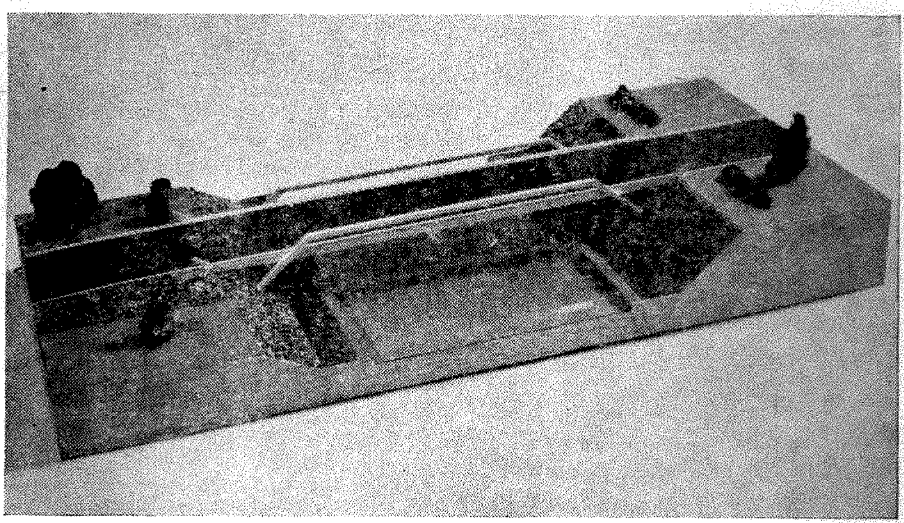
The First Prize winning entry by Roger Dorton (*vide Fig. 1*)

Aesthetics and the practical aspects of erecting and dismantling a temporary bridge have been combined together in this winning entry.

The structure consists basically of a three-span orthotropic steel plate deck girder bridge, with cantilevered end spans, supported by two trapezoidal rigid frames. This arrangement was developed to best handle erection, followed by dismantling shortly thereafter, by minimizing the cost of falsework and maintaining a high salvage value.

The two frames weigh only 15 tons together, and can easily be handled by one crane on the canal bank. These components are principally used as erection frames, then remain in place in order to support the deck during dismantling. No other falsework is required.

Though so far not greatly used for short span bridge construction, the orthotropic steel deck principle was considered desirable for this structure due to the poor foundation conditions and the salvage aspect.



Design by Roger Dorton, Montreal, Quebec, won the First Prize of $5,000.00

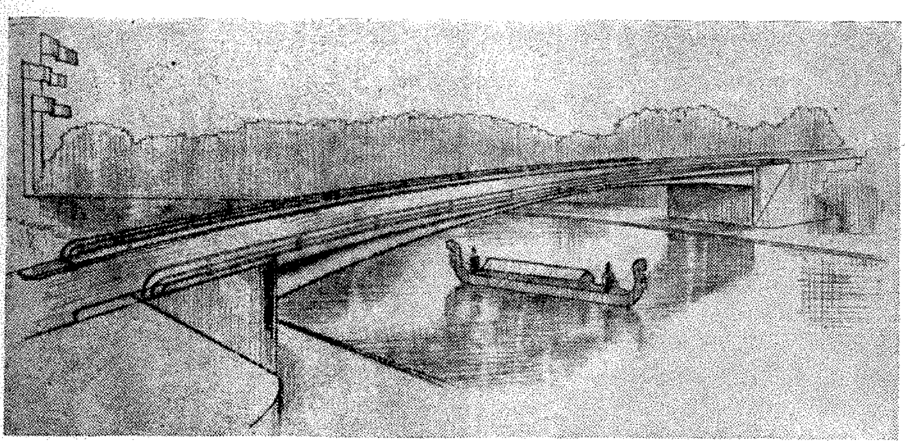
The bridge dimensions are :

Overall length ..	115 ft. 6 in.
Clear span (centre to centre of girder bearings) ..	82 ft. 6 in.
Width of roadway ..	24 ft.

The Second Prize winning entry by Brian Hope (*vide Fig. 2*)

This designer has achieved a striking and slender effect with a welded girder design, using nickel-clad steel for the exterior girders. The design employs six girders, fixed at the abutments by means of rod anchorages (with the underside following a parabolic contour), their depth varying from 6 ft. at the abutments to only 17 in. at the centre. The clean lines are enhanced by the fact that stiffeners on the exterior girders are on the inside.

Nickel cladding is employed partly to draw attention to Canada as the world's leading nickel producer, and partly for the striking contrast between the brilliant metallic surfaces and the black asphalt road surface.



Design by Brian Hope, Niagara Falls, Ontario, won the Second Prize of $3,000.00

The overall details of this bridge are :

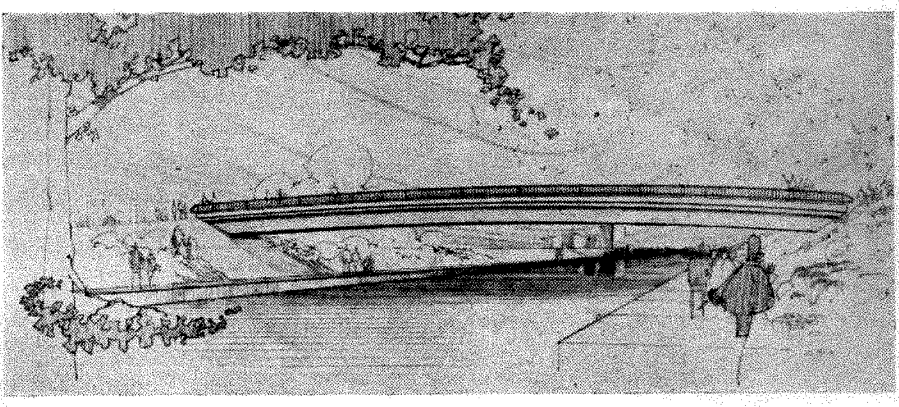
Overall length	..	102 ft.
Clear span	..	88 ft.
Width of roadway	..	24 ft.

The Third Prize winning entry by Robert Nairn (*vide Fig. 3*)

The structural elements of this design consist of two welded steel box girders of uniform depth, connected by diaphragms and acting compositely with a 7 in. concrete deck surfaced with asphalt.

The exterior surfaces of the box girders slope inwards and the same angle is maintained at the edge of the sidewalks as well as the welded steel handrail.

The result is a simple and functional span which would be economical to build and to dismantle.



Design by Robert Nairn, Oakville, Ontario, won the Third Prize of $1,000.00

The features of the bridge are :

Span (centre to centre bearings)	.. 105 ft.
Width of roadway	.. 24 ft.

Entries which received Honourable Mention

Design by Jerzy Dobrowolski of Ottawa, Ontario

This contestant has produced a three-span continuous design, the centre span being a continuous two-hinge rigid frame. There are four girders of welded steel box construction. The result is a graceful small bridge of simple design which blends with local features while providing good visibility.

The bridge is simple to fabricate and erect, field welds being kept to the minimum. The ends of the bridge are held down against uplift, at the same time providing for longitudinal movement. The intermediate bearings, forming supports of the centre-span rigid frame, are of simple hinge-type design. The steel girders are provided with shear connectors to ensure composite action with the slab. Its dimensional features are :

Overall length	.. 114 ft.
Centre span (centre to centre of pins)	.. 92 ft.
Width of roadway	.. 24 ft.

Design by Denis Tremblay of Montreal, Quebec

This engineer has produced a graceful and slender design which is as simple as possible. It provides maximum visibility and good integration with the diverse architecture surrounding it.

His solution takes into account the poor soil conditions and therefore avoids horizontal thrusts on the foundations.

The main part of this bridge is its prestressed concrete deck, provided with exterior anchoring so that the span can be re-used. Ease of erection and dismantling of the pre-fabricated deck is a feature of the design.

Guard-rail posts are integrated with the transverse prestressing system so as to cover and protect the anchor plates and wires.

The designer points out also that the details of the arrangement of abutments, joints and other elements can be modified to suit varying site conditions, without changing either the exterior form of the bridge or its main design principles. Its features are :

Overall length	.. 116 ft.
Width of roadway	.. 24 ft.

Design by Francis Boulva of Montreal, Quebec

This contestant has produced a lightweight, prestressed concrete design for a two-lane bridge. Seven similar precast hollow beams are employed. In the transverse direction, eight sets of prestressing cables are used at the ends and at equidistant intermediate points.

An aluminium curb rail is anchored to the deck with adjustable galvanized steel components.

An interesting feature is the use of repeating sculptural design motif on the sides of the bridge girders. The ends of the bridge rest on elastomeric bearings and are supported over piles driven to bedrock. The bridge details are :

Overall length	.. 118 ft.
Width of roadway	.. 24 ft.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Delhi Centre

Chairman's address by Maj.-Gen. R. A. Loomba, M.I.E., at the 38th Annual General Meeting of the Centre on January 24, 1965

After welcoming the Chief Guest, Shri Y. B. Chavan, Minister of Defence, Government of India, and other invitees, Maj.-Gen. Loomba thanked the Committee of the Centre for electing him Chairman for 1964-65.

Delivering the Chairman's address, he said, 'My first duty, a very pleasant one, is to thank the Minister for Defence for the honour he has done to the Institution in accepting our invitation to be present at this Annual General Meeting. We are grateful to you, Sir, for agreeing to be here with us today as our Chief Guest. In the discharge of your responsibilities as Defence Minister, you are aware of the magnitude of the task facing this country to prepare itself for the defence of its freedom and independence. Some of this task would naturally devolve on the shoulders of the country's engineers, and the fact that you have agreed to address us on this occasion is an indication of your interest in our affairs and an acknowledgment of the importance of the role that we have to play.

I also like to thank most sincerely my brother engineers for the great honour they have done me in electing me Chairman of this Centre for this year. As Chairman of the Centre, I am following Shri D. C. Baijal, who is Chairman of the Railway Board, and it is perhaps more than a mere coincidence that a soldier should follow a railway man, as the defence of the country is so vitally dependent upon the efficiency of its communication systems, a subject I have mentioned later in my address.

The new Bye-Laws of the Institution were adopted at Bombay in May last year. According to these, the Institution is now constituted into seven Divisions covering the different disciplines of engineering. These changes may appear revolutionary in character, but are an indication of our desire to remain united as a professional body, and it is our hope that the new constitution would attract more members, particularly from the younger disciplines of engineering, and we would as a fraternity continue to speak with one voice.

On the Roll of the Delhi Centre today, we have 1,300 Corporate Members, and 3,700 Graduates and Students. It is gratifying to have such a large membership, but it is rather disturbing to find that we do not have adequate facilities for our members, by way of an auditorium where seminars, lectures and discussions could be held, or an adequate library and other facilities so vital for the growth and proper functioning of a professional institution. It is our earnest hope and desire that these facilities should be provided, and towards that end, I like to appeal to all members to help the Centre in collecting sufficient funds, to enable us to add to and improve our building, bearing in mind the nature of other public and private buildings in this important area of the Capital city.

It is the practice of the incoming Chairman to deal with some aspects of the branch of engineering with which he is most concerned. I shall follow this example and deal with the role and functions of engineers in the Defence Services and also the nature of engineer tasks that can be foreseen in a future war. I shall, however, concern myself mainly with the Corps of engineers, a Corps to which I have the proud privilege of belonging and a Corps whose motto 'Sarvatra' (meaning 'everywhere') indicates its charter and its employment in peace and war.

The history of the Corps of Engineers covers a period of almost two centuries, during which the military engineers played an important role in the development of this country in the fields of irrigation and communication, both roads and railways. It is a tradition with the Corps that we 'take on the unusual' in the initial stages, till the task can be fully developed and entrusted to a new organization, and we look back with pride and satisfaction to the fact that the engineers were responsible for the beginnings of the Air Force, for the development and introduction of the tank, and for the formation of the Corps of Signals. The Corps has largely contributed to the organization and efficiency of the Survey Service in the country. Whilst recapitulating the past, I would also like to mention the part played by the military engineers in the sphere of technical education through the premier engineering colleges at Roorkee, Poona and Madras. The duties of the Corps of Engineers are so diverse and cover so many different fields of engineering, that we embrace and accept all disciplines of engineering within our fold.

In addition to the Corps of Engineers, there are two other sister technical Corps in the Army. These are :

(a) The Corps of Signals, born out of us and now charged with the vital task of providing communications, be they visual, line or wireless, for the proper functioning of the Army. I need hardly emphasize the fact that in modern warfare a reliable intercommunication system for the efficient exercise of command is a must, and no battle can be won without it ;

(b) The Corps of Electrical and Mechanical Engineers, responsible for keeping the equipment and weapons of the Army in a fit state of service—a task without which no modern army can fight a war ; and

(c) I like to take the liberty of adding a fourth element of engineers also, drawn from the technical services of the Defence Forces, and grouped together under the Research and Development Organisation, concerning itself with the development of equipment and maintaining liaison with other research establishments and civil industry. Though in other countries such an organisation is more directly under the control of the Services, in India, for some reason or the other, it is retained under the Ministry of Defence, with consequential problems—nevertheless, it has a vital role to play in preparing the Defence Services for a future war.

Role of the Corps of Engineers

I now like to deal specifically with the Corps of Engineers, the role of which may be simply stated as 'providing engineer support to the Defence Services in order to enable them to live, to move and to fight in furtherance of the Commander's plans'. This charter, though apparently simple, involves widely varying responsibilities from combat zones to base areas. It concerns changing and taking the maximum advantage of the geography of the ground to suit our tactical requirements.

A very important function of the Corps is to deny mobility to the enemy's forces, and to achieve and retain mobility for our own forces. This is done by judicious strategic and tactical use of artificial obstacles such as mine and demolitions ; and by the development and maintenance of our own communication systems under all conditions such as railways, roads, inland water transport, and airfields. The production of accurate survey maps rapidly contributes greatly to success in battles.

Further, the Corps is responsible for providing field fortifications, technical, storage and domestic accommodation to the three Services in all the echelons of a theatre, from forward areas through the communication zones to the base areas. This involves construction tasks, the provisioning of utilities such as water, electricity, petrol installations, and a host of other requirements to make the Services live and operate in comfort.

It would thus be seen that a Corps of Engineers Officer has not only to be a good professional soldier but also a competent engineer. We are particularly proud of our soldierly functions and responsibilities, and the recognition that we have received through the award of decorations for valour, *viz.*, the first Victoria Cross and the first George Cross of the last war awarded to the Indian Army were won by the Sappers, and the first Param Vir Chakra to be awarded to an arm other than the Infantry was to a Sapper Officer.

Engineer tasks in a future war

I shall now turn my attention to the future, and try to determine the magnitude and nature of engineer tasks in a future war.

It is important that in our planning and thinking we are ahead of the enemy. There is a great tendency to think in terms of what happened in the past forgetting that 'because of technological and scientific developments', no two wars have ever been similar. We must therefore prepare ourselves for the next war, and not for the last one.

The modern concept of 'a nation at war' makes all engineers in civilian life 'unpaid members' of the Corps of Engineers, as they would be directly and indirectly contributing in the solution of engineer problems that may arise in a future war. It is a well known fact that the most important and revolutionary advances in science and technology are made under the stress and strain of war to meet the demands of the Armed

Forces in the fight for national survival. The engineering profession as a whole must therefore take an interest in military problems and be prepared to shoulder the very heavy responsibilities that fall upon it, as modern wars are in the ultimate analysis fought and won by engineers and technologists.

A look at the map will show that because of the undeveloped nature of the terrain on our northern and north-eastern borders, and the particularly difficult conditions obtaining in these areas, a war on our border would be an 'engineers war'. Other components of the Army, no doubt, have their traditional tasks to perform, but the critical issues would concern the solution of engineering problems, and success would ultimately depend upon the equipment and performance of the engineers.

A major development of recent times has been the production of guided misiles and nuclear weapons as the forces of mass destruction. This will inevitably lead to greater dispersion of our forces in their employment, as well as in the dispersion of our industrial installations. In the tactical battle, we would require heavier field fortifications with adequate protection against nuclear weapons to be constructed with speed, thereby requiring a greater machine effort than in the past. Dispersion would also impose heavy strain on the communication systems and the transport support provided.

'Administration' which is synonymous with 'logistics support' is now an accepted principle of war—its importance having been again forcefully demonstrated in the last war by the concentration of superior forces at the right time and place. Sound administration is entirely dependant upon a reliable system of communication. It will be the enemy's constant endeavour to harass and disrupt our communications. Equally, it will be our duty to develop, improve and maintain all the different forms of communication systems upon which the Defence Forces are dependent, and to ensure that minimum disruption takes place.

This is a vast field of responsibility and I like to consider the different elements composing it separately.

Roads

Firstly, to deal with roads : roads give the maximum flexibility to a Commander for the deployment of his forces and thus greatly influence the employment of strategic and tactical reserves for a battle. Military traffic has increased greatly in volume, and military vehicles are becoming heavier, thereby demanding very high standards of construction and specifications. The intensity of military traffic would be such that widening of roads to meet the increased demands under wartime conditions would be extremely difficult, and new techniques and equipment need to be devised to carry out quick repairs whilst the roads are under sustained and heavy use. In the planning and development of our road systems, and the design and specifications for construction, we cannot now ignore military requirements in any part of the country. Increasing use of soil stabilization, and the evolution of chains of equipment for quick construction and repair of roads is an urgent necessity. Effective methods have yet to be found for dust control, for dust gives away movement of forces and military plans. It also reduces road capacity by an unbelievable degree.

While I am on the question of roads, I have to say a few words about the Border Roads Organisation, which has been building roads on our northern borders where our troops are deployed. The Border Roads Organisation is essentially staffed by Officers and NCO's from the Corps of Engineers and has the Corps knowhow fully behind it. It has done excellent work on the ground. Considering that this organisation is building military roads, and in areas where our troops are deployed, and also the fact that intimate cooperation is necessary between the road building organisation and the troops on the ground to ensure adequate build up and defence of this region, it is paradoxical to find that the Border Roads Organisation functions independent of the army. The resources of the Border Roads can be utilised for a multitude of other engineer tasks being executed by the Corps of Engineers in the same areas. For the successful execution of such tasks, it is essential that the resources are held under unified control and not held taskwise which leads to duplication and poor utilisation of resources—a thing which no nation can afford in peace or war, much less ourselves. In the event of hostilities, as it happened when the Chinese invaded India in 1962, the present arrangements will not only cause confusion, but result in inefficiency and possible failure. Organisation and resources for war must be foreseen and positioned correctly in peace.

Another important task assigned to the engineers is bridging, and river crossing is one of the most complicated operations of war requiring highly efficient rafting and bridging equipment, meticulous care in planning and speed and boldness in execution. There is no parallel to assult bridging in civil life. It is carried out under extremely trying conditions with the enemy strongly entrenched at least on the far bank and maintaining heavy fire with all the weapons at his command. Planning, movement of resources, and the launching of the operation has to be done in a matter of hours ; otherwise, surprise would be lost and the security of our forces adversely affected.

Famous river crossings from the last war which come to my mind are the Irrawaddy crossing in Burma carried out by four Divisions, and the one in which an entire Division gained surprise and tactical advantage through speedy and bold execution of a river crossing over an obstacle over a mile wide with difficult and sandy approaches—an engineering feat which has so far not been surpassed. In the deliberate Rhine crossing, which was also made on a four Divisional front, it is interesting to note, that one-fourth of the entire combat force in the area consisted of engineers. This will give some idea of the engineer effort required for the execution of any large scale river crossing operation.

An outstanding invention of the last war—the Bailey Bridge—is now outmoded and fast becoming obsolete. It is too slow in erection to keep pace with the increased tempo of the next war.

A good military bridge must be light, easily manhandled, and quick to erect. It must be capable of assembly some distance away from the gap, and of quick launching in minimum time in the face of the enemy and under heavy fire. These are very stringent demands, and no one set of equipment can meet dry as well as wet requirements. There is a tendency to make bridges heavier and heavier, and to use mechanical devices for handling the equipment. Another important trend is to use amphibians, with superstructure fitted on top, which can be easily coupled when the amphibians are driven into position. Such bridges can be assembled or broken to suit the tactical situation. Greater use of helicopters is likely in the future for placing assembled bridges across restricted sites.

Here then in the field of design and development of military bridges, is a challenge to be taken up by the engineers of our country.

Airfields

No means of communication can be faster than air transport, and airfields will, therefore, necessarily play a major part in affording mobility to our forces in the future, and also in denying mobility to the enemy through the use of bombers from the same runways.

Aircraft is however becoming faster and heavier, and equivalent single wheel loads have reached 68,000 lb. for transport aircraft, whilst tyre pressures are over 200 lb. per sq. in. for fighter aircraft. This calls for longer and stronger runways.

Any nation at war must make full use of its civil air communications for increased logistics support to the forces. In the development of civil aviation in peace, therefore, the strategic and tactical requirements of our land and air forces must be taken into account.

As I have stated earlier, disruption of communications and destruction of airfields and airpower would be given the highest priority by an enemy. This would pose the problems of quick and satisfactory repair for different types of surfaces, as it would not be desirable to close an airfield for more than a couple of hours. This requirement therefore indicates once again greater use of machines, better materials and faster methods of construction for engineer tasks of this nature.

For the rapid construction of temporary airfields during the last war, prefabricated materials such as pierced steel planks (PSP) and pre-bitumenised surfacing (PBS) were used in large quantities. We now find that with modern jet aircraft these materials are useless. Work is in hand to develop an improved and light prefabricated surfacing material to cope with the loads imposed by modern aircraft. There will always be demands for quick construction of airfields to meet the changing pattern of tactical requirement, which cannot be foreseen in peace. In fact, the military engineer would be required to put down an air strip in a matter of a few weeks, if not days.

Even for permanent requirements, the emphasis is on speed of construction, and I say it with pride that our northernmost and easternmost airfields were constructed in 4 to 5 months, thereby ensuring that we would have been ready in these areas if the worst had happened.

Equally important and urgent is the problem facing the aeronautical engineer designing for the next war—for he must think in terms of shorter runs for the aircraft; the ideal no doubt would be a vertical take off craft requiring no runway at all. Considerable work is now going on in various countries to develop and improve short take off and vertical take off aircraft.

Railways and inland water transport

The Corps of Engineers has within its fold organisations and units to deal with railway and inland water transport communications, as these are also the traditional responsibilities of the Corps. As the military requirement today is confined to within our frontiers, we have every hope and faith that the civilian organisations concerned would equip and train themselves in peace to keep these communications open in times of war, without too much dependence upon the Corps of Engineers, which is going to be more than fully occupied with other tasks.

Mine warfare

Mine warfare is an important and powerful tactical weapon in the hands of a Commander, as it helps to deny mobility to the enemy. It may be said that the mine has almost brought the tank to a standstill. Great secrecy is observed by all nations in the development of mines, and the balance of the battle between the mine and the tank will only be gauged when war breaks out.

Anti-personnel mines are an essential and indispensable weapon in land battle. They impose caution and fear in the minds of the attacking troops, and though an enemy may accept large scale and disproportionately high casualties at certain stages of a war, he cannot with impunity do so over a long period of time without seriously affecting the morale of his troops.

A mine should be small yet powerful, easy to lay but hard to detect, and capable of taking complicated devices which make lifting dangerous and slow.

Greater use is being made of mechanical means for laying large scale minefields and the helicopter will have to play an important part in this respect. However, the breaching of mine fields in depth is still a slow and cumbersome process, thereby imposing delay and restrictions in the large scale employment of tanks. The solution may lie in the field of explosives or mechanical or even electronics means for exploding a path through the mine field. A judicious use of demolitions in conjunction with mines can impose considerable delay on the movement of enemy forces.

In addition to the tasks mentioned so far, the Corps has the responsibility of providing storage and domestic accommodation, workshops, factories and hospitals, and the development of harbours and dockyards. Our workload for capital projects is around Rs. 100 crores a year, and if the maintenance load and the Border Roads budget are also included, we find that the Corps of Engineers is handling a budget of nearly Rs. 200 crores, which is a tremendous task by any standard of assessment.

I have tried to show the vital importance of reliable communication systems, and the need for civilian organisations to prepare themselves to be able to maintain these systems at a high pitch under the stress and strain of war. The magnitude of engineer tasks is so vast that the Corps of Engineers would have its hands full, and in the national interest, the Corps in wartime should be relieved as much as possible of tasks which are within the capacity of civilian organisations.

Further, I have tried to show the increasing dependence on machine power for speedy execution of engineer tasks, and the necessity for constant study and evolution of new methods and techniques in various fields of engineering. There is immediate need to assess the strategic and tactical requirements of our Defence Forces, and to incorporate their demands in the design and planning of our transportation systems. The cost of doing this at the initial stages would be much less than carrying out the required changes under war conditions.

Situated as we are, with a major threat along our northern borders, we have to face and overcome the problems and handicaps of operating at high altitudes, combined with conditions of arctic cold. These problems not only affect the performance of machines but also the fighting efficiency and morale of men. You, Sir, are fully aware of these problems and are taking action to overcome these handicaps, through the provisioning of suitable equipment and better living conditions at these altitudes.

We may know the problems that are likely to face us in a future war, but this knowledge is of little help if our industry is not in a position to develop and produce the equipment that we need. Our aim, as stated so often, is self-sufficiency and this would only be achieved when there is greater 'defence consciousness' in the nation as a whole, and greater collaboration between the Services and industry in the field of development. We, as military engineers, like to make the maximum use of commercial equipment and standardise upon it, for then and then alone, we would be able to employ effectively civilian resources made available to us at the outbreak of hostilities. Plans also must exist to convert civil industry to war requirements at short notice.

Conclusions

I do not propose to expand any more on the many ways in which engineering can contribute to success in land battle. Modern wars require mass employment of machines with their attendant problems, and new weapons dictate new methods of warfare, which have profound influence on the nature of military engineering. Whatever the precise nature of engineer tasks in the future war, it seems inevitable that their urgency, and scope and magnitude would impose a severe test on the entire engineer resources of the country, and on its technical skill and production capacity. The effectiveness of engineer effort depends on increasing mobility and speed of execution, reducing bulk and weight of materials required, and doing more and more with less and less.'

Kerala Centre

Chairman's address by Shri T. P. Kuttiammu, M.I.E., at the 18th Annual General Meeting of the Centre on February 9, 1965

After welcoming the Chief Guest and other invitees, Shri Kuttiammu thanked the Committee of the Centre for electing him Chairman for 1964-65.

Delivering the Chairman's address, he said, 'Conscious of the heavy responsibilities that go with the privilege, I shall strive hard in my own humble way to uphold the high traditions of this Institution, expand its manifold activities in the technical and professional fields, and increase its usefulness. The membership of the Institution has been steadily increasing; it has to increase still further so that the Institution becomes fully representative of all those who are eligible for membership and its usefulness becomes broad-based. On the construction side, we have to improve the acoustics of the Local Centre building, add an Examination Hall, effect substantial additions to its furniture and fittings, and try to secure sites for small buildings for our Paper Contres in other towns. The present Paper Centres will have to be strengthened and now one opened in places like Ernakulam, Calicut, etc. More and more technical meetings should be organised at all these Centres. In short, our Local Centre must be very effective and active, and through its initiative and inspiration, the standard of technical efficiency and professional integrity in the State should steadily improve. All this can be achieved only with the wholehearted cooperation and active participation of all the members, and I am confident that this cooperation will be forthcoming.

Many members of this Local Centre are all directly concerned with the developmental activities in the State. One of the burning problems we are called upon to tackle is food production and I am intimately connected with it. That Kerala is very much deficit in rice and has to continue to be so for a long time is well known. Whether she can ever become self-sufficient in food, whether it will be prudent to try and secure self-sufficiency without reference to the ultimate economy thereof, whether food production should be given a higher priority than at present, etc.—are points that are widely discussed. To get a correct appreciation of the position, we will have to look into some figures.

The population of Kerala is nearly 170 lakhs at present; it is steadily increasing and by 1981, *i.e.*, by the end of the next three Plan periods, it may reach 250 lakhs. The staple food of this huge population is rice. Taking the average requirement per head at 12 oz., we need 21 lakh tons of food per year. This will increase with increasing population and may reach 32 lakhs tons by 1981. Rice is now grown on 12.3 lakhs acres of land. With double-crop in about 50% of the land, the crop area will be 19.83 lakh acres. The yield last year was 11.11 lakhs tons, giving an average of 1,250 lb. per acre. Both the crop area and the yield should be increased. Of 15,000 sq. miles of land in the State, 47% is cultivated, only 30% of which is used for paddy. Cash crops like cocoanut, arecanut, tea, coffee, cashew, banana, etc. are very paying and it will neither be practicable nor economically justifiable to convert them to paddy. Deforestation for cultivation purposes is out of question. By the provision of irrigation, a few thousand acres of waste land can be brought under the plough. In the coastal regions, we have the backwaters and lakes with their bed a few feet below the mean sea level. By preventing salt water intrusion, by dyking and dewatering, and by correcting the deficiencies of our soil, some of these areas can be reclaimed for paddy cultivation.

Conversion, reclamation, etc. may together give us an additional net area of 1.2 lakh acres, raising the total to 13.5 lakh acres. With irrigation, flood control, salt exclusion and other works, an average of two crops can be raised on the entire area, bringing the gross crop area to 27 lakh acres. On one acre, we are now getting 1,250 lb. of rice, as already stated. By evolving better strains, soil correction, proper manuring, deep ploughing, pest control, etc., the average yield can be increased at least to 1,650 lb. and the production on 27 lakh acres will then be 19 lakh tons. We propose to plan for a target of 17 lakh tons by the end of the Fourth Plan and achieve a production of 19 lakh tons by 1981. The requirement will, however, have by that time risen to 32 lakh tons and our deficit will still be over 40%. In other words, if we carry out all these measures, we may just prevent the deficit from getting more acute, the additional production only going to balance the increased demand due to increasing population.

While population growth can continues further, there is a limit to the increase in the production of rice. Change of food habits will therefore be inevitable and the sooner it is realised and effectively tackled the better. The recent food crisis obliged our people to take to wheat. This is a welcome sign and should be encouraged and sustained. Tapioca, strengthened with proteion-giving groundnut or fish, is a good supplement. It can be grown in all places and in all seasons in Kerala. The yield per acre is about 2 tons or more and can be increased further. Fishing should be developed in the State. With supplementary foods made available at reasonable prices, the need and demand for rice can be cut down considerably and self-sufficiency in food can be made practicable.

It is therefore clear that development of irrigation and allied works to the maximum possible extent is of utmost importance to the State. Irrigation works of the type obtaining in other parts of India are neither required nor economical in Kerala. Schemes suitable to the conditions in this State and having favourable cost-benefit ratios are available in plenty. Many of thse are of multipurpose type. Storage dams constructed for hydro-electric power can be utilised for irrigation and flood control. On Kuttiadi, Chaliyar, Bharatapuzha, Chalakudy, Periyar and Pamba rivers, hydel schemes have been planned and these rivers are useful for irrigation also. Good storage schemes for irrigation, without power, are possible on rivers like Chandragiri, Kariangode, Peruvamba, Kuppam, Valapattanam, Kadalundi, Karuvannur, Kallada, Vamanapuram, Karamana and Neyyar. On some of the other rivers, diversion schemes are available. A scheme for strenghtneing the dykes in Kuttanad and Trichur Kole for double-crop cultivation is proposed to be investigated at a cost of about Rs. 50 lakhs with the aid of the Food and Agriculture Organisation. This investigation will involve aerial survey, contouring, soil survey, engineering design, research, etc. and will cover every aspect of backwater reclamation. It will be the forerunner of several smaller schemes of similar type. A thorough study of all the minor basins and backwaters is also being taken up for minor irrigation and land utilisation throughout the State. Along with the development of hydro-electric power and its spread in the rural areas, a new drive for the extension of lift irrigation will also be made. Irrigation of cash crops will be a new feature of our future irrigation pattern. The Research Institute at Peechi has come of age and is playing an increasingly effective part in the development of our water resources and in the improvement of our engineering techniques. A journal on irrigation is also proposed to be published by the Institute.

The overall cost under irrigation may come to about Rs. 100 to 120 crores. Spread over a period of 15 years, the annual allotment may be about Rs. 5 to 10 crores. It may be difficult to accommodate this fully within the State ceiling of the Five Year Plans. If the major irrigation projects costing above Rs. 5 crores like Kallada, Idikki, Kuriarkutty, Kuttanad, etc. could be financed outside the State Plan or without reference to the Plan ceiling, the prospects of speedy implementation of our projects will be very bright indeed. It will be a challenge to the people, to the Government and to the engineers, and a worthwhile challenge, as it will solve our food problem, and we on our part will not be found wanting.'

Summaries of Papers Published in the Journal, vol. 45, no. 11, pts. CI 6, ME 6, and MM 3, July 1965

CIVIL ENGINEERING DIVISION

Design of Bidyadharpur Barrage

K. C. Das
Member

The Bidyadharpur Barrage is an important hydraulic structure of the Salandi irrigation project in Orissa. Located about 5 miles below the Salandi dam and designed for a maximum discharge of 115,000 cusec., the barrage will provide water into Salandi main canal (left) and connect Baitarani left canal with the Salandi canal system. This paper describes briefly the procedure adopted for the design of the Bidyadharpur Barrage and its appurtenant structures.

Effect of Cement Quality on Coarse Aggregate Requirement in Cement-Concrete Mix*

G. G. Kelkar
Student

Design of Panset Dam Spillway Based on Hydrology of Catchment Region*

G. G. Kulkarni
Associate Member

Analysis of Folded Plates by the Method of Additional Ridge Loads*

N. Shanmughasundaram
Associate Member

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* Summaries of these papers were published in the *Bulletin*, vol. 14, no. 9, May 1965.

Energy Dissipation in a Submerged Axially Symmetric Jet*

N. S. Shashidhara
Non-member
and
Prof. K. Seetharamiah
Member

Computation of Curvature and Deflection of R.C.C. Beams and Colums*

N. S. Sinha
Associate Member
and
V. S. Rane
Non-member

Matrix Analysis of Finite Beams on Elastic Foundation

Dr. K. T. Sundara Raja Iyengar
Associate Member

Finite beams on elastic foundation under any arbitray distribution of lateral loads, with any end conditions are analyzed using the concept of transfer matrices. Only two equations in two unknowns will have to be solved for any type of end conditions. Extension of this method to beams of variable rigidity is indicated. The solution is given in terms of several functions whose numerical values are tabulated.

Studies on Design of Revised Profile for Bhakra Dam Spillway*

Dr. H. L. Uppal
Member
T. D. Gulati
Non-member
and
B. D. Sharma
Non-member

Pneumatic Sinking of Well in North Koel Bridge Foundation*

Vijaya Singh
Non-member

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* Summaries of these papers were published in the *Bulletin*, vol 14, no 9, May 1965.

CONCRETE CONSTRUCTION GROUP

Carryover and Stiffness Factors of a Two-Way Slab*

Dr. P. Dayaratnam
Associate Member

ROADS AND ROAD TRANSPORTATION GROUP

Contact Stress Between Bullock Cart Tyre and Road Surface*

Y. C. Gokhale
Associate Member
and
R. S. Mehta
Student

Planning of Highway System in Assam*

G. C. Sharma
Member

MECHANICAL ENGINEERING DIVISION

Optimum Pressure Ratio in a Multistage Reciprocating Compressor

M. S. Keshav
Non-member
and
R. N. Reddy
Non-member

Although interstage cooling plays a vital role in reducing the power consumption of a compressr, not much is known about the optimum pressure for interstage cooling under practical conditions of cooling at that stage. This paper presents a general expression for the calculation of the optimum intercooler pressure for the minimum power consumption for various degrees of intercooling.

Preloading of Bearing in a Machine Tool

G. Mitra
Non-member
and
S. K. Basu
Associate Member

Improved performance of a machine tool can be obtained by minimizing the axial or radial play in the various bearings which are used as spindle supports to obtain accurate rotation of the spindle, greater stability under dynamic loads and higher wear resistance between the rubbing surfaces. Preloading of the bearing is the principal method for increasing its accuracy. This paper analyzes theoretically the extent to which a bearing can be preloaded and the procedure is illustrated by a numerical example. Various methods for the preloading of a bearing are also briefly described with special reference to a new preloading device comprising a taper housing.

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* Summaries of these papers have been published in the *Bulletin*, vol. 14, no. 9, May 1965.

Effect of Heat Loss on Thermal Efficiency of I.C. Engines

N. N. Narayan Rao
Associate Member

This paper describes a method for determining the effect of heat loss on the thermal efficiency and power output of an internal combustion engine. In the calculations, the space average of the instantaneous values of the various parameters are used. The calculation procedure is illustrated by a numerical example considering the gas temperature and the heat transfer coefficient as functions of the crank angle.

Noise Control in Air-Conditioning Systems

T. L. Sitharama Rao
Non-member
and
Dr. S. V. Narasimhan
Non-member

The increase in efficiency and comfort obtained by air-conditioning is practically offset if the noise created by the plant exceeds a specified level. This paper presents a study on the noise produced in a mechanical air-conditioning system and describes the methods of selection of suitable noise control criteria with the help of noise criteria (N.C.) curves. The performance and choice of several noise attenuating elements are also discussed.

Determination of Optimum Turning Speed—a Case Study

S. Vaidyanathan
Non-member

This paper presents a theoretical analysis of the machining cost in metal cutting operation and derives a relationship between cutting speed and machining cost for turning operation. It shows that there is a definite cutting speed corresponding to the minimum machining cost. The data obtained from experiments conducted in a machine shop for producing components of Diesel trucks are also given.

MINING AND METALLURGY DIVISION

Geophysics and Engineering

Dr. V. K. Gaur
Non-member

This paper describes the geophysical methods for exploring the shallow regions of the earth's crust with particular reference to their suitability for the solution of engineering problems. Several engineering problems arising in seismically disturbed areas are discussed and the need for specialized research for their solution is indicated. The design of an instrument for measuring the behaviour of the magnetic field and the elastic constants in a region undergoing elastic strain is also presented. The electrical methods presented in this paper can also be applied to hydraulic problems, *e.g.*, delineation of leakage zones in canals and mapping of phreatic surfaces.

Automation in Dolomite Brick Manufacture

Ing. W. Schurmann
Non-member

Introduction of the oxygen processes in steelmaking has created an exacting demand on the properties of dolomite bricks which are used in the linings of a converter. This paper describes a fully automatic method for the manufacture of high quality dolomite bricks which requires only one press operator for the control.

Present Status of Coal Mine Mechanization in Europe—1

R. K. Singhal
Non-member

This paper briefly reviews the growth of the coal mining industry in Europe with particular reference to the mechanization at the coal face. The latest machinery used in the various processes of coal mining in Europe are also described.

INSTITUTION NOTICES

Application forms for Sections A and B of the Associate Membership Examination (Old Scheme) to be held in November 1965

Application forms for Sections A and B of the Associate Membership Examination (Old Scheme) to be held in November 1965 are attached to this issue of the *Bulletin*. The programme of the examinations and the detailed instructions are also attached with the application forms, and they may be detached for reference, if so desired. These application forms, the programme of the examinations and the detailed instructions are printed on white paper **(in black ink)** to distinguish them from those applicable to the New Scheme which are printed on white paper **(in red ink).** Students are notified that no further application forms will be distributed to them.

Applications complete in all respects and accompanied by the examination fee for admission to the November 1965 examinations and one copy of passport size photograph pasted in the space provided on the application form should reach the Head Office before 4.00 p.m. on Wednesday, September 15, 1965.

Application forms for Sections A and B of the Associate Membership Examination (New Scheme) to be held in November 1965

Application forms for Sections A and B of the Associate Membership Examination (New Scheme) to be held in November 1965, printed on white paper **(in red ink)**, are attached to this issue of the *Bulletin*. The programme of the examinations and the detailed instructions printed on white paper **(in red ink)** are also attached with the application forms and they may be detached for reference, if so desired. Students are notified that no further application forms will be distributed to them.

Applications complete in all respects and accompanied by the examination fee for admission to the November 1965 examinations and one copy of passport size photograph pasted in the space provided on the application form should reach the Head Office before 4.00 p.m. on Wednesday, September 15, 1965.

Sections A and B of the Associate Membership Examination— Option to Students to appear in the Old Scheme

It is once again notified for the information of candidates that they will not be permitted to appear for the Old Scheme of examinations to be held in November 1965 in Section A or B, unless they have at least one exemption to their credit. Candidates not fulfilling the above condition and submitting application forms for the Old Scheme of examinations will have their applications rejected

Sections A and B of the Associate Membership Examination— Limitations to number of candidates at examination centres

The Examinations Committee have decided that the number of candidates appearing at any examination centre should be restricted to 750 only, in view of the difficulties experienced in making arrangements.

Candidates intending to appear in the examinations should mention in the examination application form the name of three examination centres in order of preference, and the Controller of Examinations will allot each candidate the centre at which he will be permitted to appear. Candidates who fail to mention more than one examination centre will be allotted any centre of examination at the discretion of the Controller of Examinations. No individual representations will be considered after the allotment of the examination centre is made.

Changes in the programme of Section B Examination (New Scheme)

Attention of candidates is invited to the changes in the programme of Section B Examination (New Scheme) made by the Examinations Committee. The revised programme is attached to this *Bulletin* along with the examination forms.

Despatch of Admission Cards and Results of Examinations

Students are informed that Admission Cards and Results of examination will be sent only to their addresses as registered by them in the Institution Head Office at Calcutta.

Rechecking and retotalling of marks

Candidates wishing to have their answer-books rechecked and retotalled must apply to the Controller of Examinations by name, enclosing a postal order for the fee to be paid for this purpose, along with the application. This will facilitate rechecking of answer-books. Remittance of money in any other form or without enclosing the postal order with the application, or applications to the Controller of Examinations not addressed by name, may result in unnecessary delay.

Payment of subscriptions, examination fees, etc.

The Council has directed that hereafter all payments to the Institution shall only be made : (1) by demend draft drawn on a Calcutta bank or by cheque sent by post (70 p. being included as charges in the case of an outstation cheque) ; (2) in cash tendered at any branch in India of the State Bank of India along with bank cards A and B ; (3) in cash, cheque or demand draft deposited at the cash counter of the office of the Institution Headquarters in Calcutta ; and (4) by postal order to a maximum of Rs. 10 for the cost of publications and Studentship application registration fee only.

It may be noted that any payment by money order or by postal order other than as mentioned in (4) above cannot be accepted.

Appointment of Referees

From time to time, Corporate Members write and ask if the appointment of Referees, lists of whom are periodically published in the *Bulletin*, is an exclusive matter. In clarification, the Secretary wishes to say that these lists of Referees have been printed in the *Bulletin* over a number of years, in fact, ever since the Referee system was introduced for interviewing Students of the Institution who are candidates for appearing in Section B of the Associate Membership Examination. The selection of certain Corporate Members by the Local Centres for acting as Referees does not in any way extend any special or exclusive privilege to them. All Corporate Members may act as

Referees, and the Council have asked the Local Centres to propose the names of such Corporate Members who are willing and available to act as Referees simply with the object of assisting the Students, who by reference to these periodically published lists of Referees, are enabled to select their particular Referee and register with him for the necessary interviews. Any Corporate Member who has the necessary time and who is willing to act as Referee may inform his Local Centre. No addition to the lists is made by or at the Headquarters, where the names received from the Local Centres are merely compiled for publication in the *Bulletin*. By the publication of these lists, no distinction amongst the Corporate Members is intended or made.

FORTHCOMING CONFERENCES

Fifteenth Sectional Meeting of the World Power Conference, Tokyo, October 16-20, 1965

The 15th Sectional Meeting of the World Power Conference will be held in Tokyo, Japan, from October 16 to 20, 1965. The Japanese National Committee of the World Power Conference will be the hosts to the 15th Sectional Meeting and the theme of the meeting is 'Problems of Future Years in Energy Utilization'. The object of the Conference is to study new developments in energy utilization and its structural changes as well as to examine the important problems of the rational utilization of energy in the future. The problems which will be presented by the general theme will cover a wide range of subjects. However, in view of the fact that the difficulty of forecasting energy requirements in the future mainly lies in the rapid changes which are likely to take place in the fields of both demand and supply, new developments in these fields should be studied, putting emphasis on the subjects that have influence and/or interrelation with demand and supply of energy. The important problems which are now under study and the new developments of technically proven practices which have a prospect of prevailing application are of special interest.

The words 'energy utilization' used in the technical programme are interpreted in a broad sense, and include, in addition to consumption of energy by the final consumer, transportation and storage of energy, and conversion of energy for the purpose of optimizing its consumption.

The general theme is divided into three divisions and each division is sub-divided into sections. Division I deals with the general aspects of energy utilization; Division II deals with the fields of conversion of primary energy into secondary energy (including hydro-electric and nuclear power), and also transportation and storage of various forms of energy; and Division III deals with the problems of consumption of energy in the various sectors of demand. The nature of the subjects to be treated and the problems which require special attention are described in the technical programme Therefore, authors are requested to prepare their papers selecting impartant problems which are now under study or which are urged to be solved in the immediate future.

Copies of the technical programme can be obtained from the Technical Officer (Scientific) at the Headquarters of the Institution at Calcutta.

NAMES OF SUCCESSFUL CANDIDATES IN THE STUDENTSHIP ASSOCIATE MEMBERSHIP EXAMINATIONS HELD IN NOVEMBER 1964

The following candidates have been declared to have passed the Studentship and Associate Membership Examinations held in November 1964.

STUDENTSHIP EXAMINATION

Roll No.	Name of candidate	Roll No.	Name of candidate
St. 4	T. D. N. K. Kartha	St. 404	S. K. Dhawan
St. 51	A. C. Joshi	St. 421	P. S. Krishnan
St. 73	D. T. Reddy	St. 431	Anand Pal
St. 96	Anant Gopalrao Jatkar	St. 436	A. M. Sen Sharma
St. 102	D. N. Kathuria	St. 445	B. B. Bhaduri
St. 109	N. G. Swarnkar	St. 447	Gyan Chand Beri
St. 118	S. Srinivasan	St. 459	B. B. Pai
St. 142	R. A. Sikka	St. 462	P. S. Paul
St. 146	S. H. Hasamnis	St. 468	S. W. Ponraj
St. 150	Pillai Manoharan	St. 471	I. P. Sharma
St. 157	V. K. Talwar	St. 472	D. V. Rammohan Rao
St. 171	J. Singh	St. 475	K. S. R. Poduval
St. 175	K. K. Ravindran	St. 480	P. S. Satyanarayanan
St. 190	B. Nath	St. 487	S. Kanagarajan
St. 193	S. Sandel	St. 488	D. V. Subba Rao
St. 201	S. Vedagiri	St. 507	C. M. Kutty
St. 225	D. S. Marwaha	St. 513	A. Srinivasan
St. 232	Karam Chand Bajaj	St. 520	K. N. Ramachandran
St. 249	Gurnam Singh Dhaliwa	St. 527	S. Srinivasan
St. 250	H. C. Kawatra	St. 530	N. G. Premsagar
St. 277	K. Singh	St. 535	T. E. Gopalan
St. 281	S. K. Jain	St. 555	G. Govindan
St. 296	G. S. Paul	St. 586	A. N. Garg
St. 299	Man Mohan Lal Batra	St. 602	D. N. Sharma
St. 301	M. C. Bahughna	St. 604	G. Singh
St. 318	K. V. Sarma	St. 607	G. L. Naula
St. 332	K. N. Krishnan	St. 617	M. S. Chopra
St. 335	P. V. R. K. Visweswararao	St. 654	T. J. Mobedji
St. 339	S. Suryanarayana	St. 662	B. V. Bapat
St. 347	F. Mirza	St. 679	G. A. K. Nair
St. 355	P. Vithal	St. 701	M. A. Devassy
St. 369	M. P. Jain	St. 703	K. P. Narayanan Nair
St. 375	N. R. M. Rao	St. 704	C. M. Zechariahs
St. 384	N. S. L. N. Acharyulu	St. 715	V. V. Nair

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A

(Existing Scheme)

Roll No.	Name of candidate	Roll No.	Name of candidate
1A	Jai Prakash Vaish	18A	Narendra Trikamlal Shah
11A	Bipin Chimanlal Shah	40A	R. S. Shah

ASSOCIATE MEMBERSHIP EXAMINATION SECTION A—*contd.*

Roll No.	Name of candidate
43A	Gurdayal Singh
47A	Ghanshyam Ambalal Bhatt
54A	Shyam Swarup Rastogi
56A	Chaman Lal Anand
60A	Palaparty Sumukheswar Rao
66A	S. Adinarayana
73A	R. S. Murthy
75A	R. S. Krishna Murthy
88A	T. R. Suryanarayana
94A	Y. Thippeswamy
99A	H. S. Subramanya Iyer
105A	K. S. Shallappa
109A	M. L. Dwarka Prasad
112A	V. R. Murthy
119A	Uchil Prabhakar
129A	Z. Baig
132A	A. C. Baboo Ram Misra
135A	K. S. Chandramouli
137A	H. S. Srinivasa Rao
141A	C. R. Ramaswamy
145A	H. M. Abdul Khiyum
158A	Mallanda Pemmaiah Devaiah
163A	K. Ravindranath Pai
176A	H. N. Santha Rajaiah
187A	B. S. Sundarappa
202A	D. R. Krishnan
205A	C. V. Prasad
208A	M. S. Gurunatha
211A	S. Balasubramanian
227A	R. Kasiviswanathan
234A	G. N. Jyoti Shankar
238A	Muppirala Krishna Murthy
243A	P. V. Krishna Reddy
244A	Pappuraja Srirangan
252A	Krishan Chander
256A	N. N. Mehta
263A	Suraj Bhan
273A	Kumarpal Lallubhai Shah
274A	Limaji Narsai Patil
278A	Raojibhai Shanabhai Patel
281A	Ram Tikamsingh Hemrajani
282A	Charanjit Lal Bedi
290A	Gur Saran Das Anand
294A	Kailash Narayan Misra
296A	Parshotam Lal Plaha
297A	Rajagopalan Krishnamurthy
298A	Nune Sreehari
300A	Shiva Bhushan Naik
301A	S. S. Appa Rao
306A	Chander Mohan
318A	M. S. Malhotra
327A	J. P. Salhotra
337A	Virender Kumar Thapar
339A	Divakarla Rama Krishnarao
345A	Jatinder Nath Kalia
350A	Kailash Narain Nema
353A	Rajwant Singh Sethi
354A	Narendra Kumar Gupta
357A	B. L. Gupta
358A	D. C. Naidu
360A	Mathuraimuthu Rajagopal
363A	Ramji Misra
364A	Anand Swarup Gogia
369A	K. Gopal Bhat
378A	Tilak Raj Gandhi
386A	Om Parkash Puri
391A	Avtar Singh
398A	Jamuna Prasad Pathak
399A	Premnath Seithi
401A	Surendra Narain Agarwal
406A	Krishna Pada Acharyya
416A	Jagdish Kumar
424A	Manik Chandra
425A	Shiv Das Mathur
427A	Ashok Kumar Chib
428A	Kshiteshwar Pandey
429A	Prahlad Singh
432A	Mohd. Hussain
447A	Madan Mohan
448A	Ramesh Chandra Khera
451A	Om Prakash Mehta
452A	Mohinder Singh
453A	Krishan Parshad Kalia
457A	Narayanan Seshan
458A	K. K. Saxena
464A	Krishna Kumar Tyagi
469A	K. D. Saxena
471A	Anand Murari Mathur
485A	V. K. Sharma
492A	B. B. Sharma

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
496A	Y. Singh Rathore
498A	T. Natesa Shunmugaraj
501A	S. C. Shukla
502A	C. S. Radhakrishnan
504A	M. V. Dharaneepathy
506A	Har Prasad
509A	K. J. Kulkarni
524A	A. S. Raje
531A	Manohar Khushiram Keswani
535A	S. Chatterjee
536A	Madhukar Daji Lad
539A	Yashawant Vishnu Risbood
552A	Kheta Pachan Patel
562A	J. S. Virdi
563A	Tulsi Dhalumal Dharmani
570A	M. D. Deshpande
575A	Annappa Anant Prabhu
576A	Jethalal Ramanlal Shah
590A	Diwakar Hari Joshi
592A	M. V. Shiravadekar
598A	S. R. Ranade
600A	Tadivaka Bhimasankara Rao
602A	Ramesh Sonu Patil
605A	Umesh Chandra Vidyarthi
617A	N. R. Malik
620A	B. G. Riswadkar
621A	P. R. Mudgal
624A	Yusuf Ishakbhai Sitabkhan
633A	Chaturbhuj Narwani
643A	Anoop Singh Wadhwa
645A	Bhimsen Chandiramani
666A	Douglas D'Souza
682A	S. S. Vaidya
697A	V. B. Tendulkar
702A	Seetharama Bhatta
705A	S. V. S. Rao
710A	Faredun Erach Mirza
712A	Srinivasan Narayanan
720A	C. B. Waghulde
722A	Mahadev Basappa Koppa
724A	Sudhakar Narayan Barde
728A	Sanjoy Kumar Chanda
729A	Vijaya Prakash Joshi
730A	M. C. Parekh
733A	Vijaykumar Ganesh Pradhan
747A	M. C. Prabhakara Rao
748A	C. V. John
772A	Radhey Shiam
791A	R. K. Bandyopadhyay
804A	Priya Mohan Bhowmik
808A	Samar Kanti Ghosh
809A	Amitava Ghosh
814A	Swayambhu Bhattacharya
819A	A. M. Bandyopadhyay
820A	Shyama Pada Hui
827A	Gopalan Natesh
832A	Malay Mohan Ray
856A	Swades Ranjan Sengupta
872A	Rajat Kumar Mukherjee
883A	Subhash Ranjan Ghosh
893A	Alok Nath Hajra
899A	Dipak Kumar Bose
902A	Barunbaran Chakrabarty
913A	Pradip Chandra Sen
917A	P. K. Banerjee
921A	Ranabir Roy
927A	Ranjit Kumar Dutta
929A	Subodh Chandra Chatterjee
933A	Harisankar Ray
935A	Susil Kumar Mandal
950A	H. N. Sarkar
955A	Asoke Kumar Sengupta
959A	Ajoy Kumar Sinha
967A	Nanda Dulal Choudhury
974A	Shashanka Mukherjee
981A	Ramendu Das Gupta
983A	Probodh Ranjan Sarker
985A	Mrinmoy Kumar Pan
986A	Bhagat Ram
1004A	Alok Kumar Mitra
1005A	Tushar Kanti Chongder
1011A	Syamal Kumar Mukherjee
1018A	Raj Kishore Singh
1019A	Thippavajjula Ramamurthy
1021A	Partha Sarathi Datta
1029A	Sukumar Chandra Saha
1030A	Bholanath Bhattacharyya
1031A	P. K. Moulik
1033A	T. K. Basu
1042A	Shivnath Paranandi

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
1048A	Animesh Roy Chowdhury
1049A	Jyotirmoy Basu Ray
1051A	Srikrishna Bhattacharyya
1054A	M. U. Alam
1065A	Dipta Kumar Das
1069A	Umapada De
1070A	Debapriya Brata Ghosh
1075A	N. C. Pratihar
1077A	Baini Singh
1079A	Baikuntha Dev Ganguly
1081A	Dulal Kumar Ghosh
1106A	Sujit Kumar Rudra
1113A	S. C. Chakraborty
1121A	L. R. Mallik
1124A	Sanat Kumar Chuckravarty
1126A	A. K. Das
1127A	Bimalendu Das
1140A	Sontosh Chakraborty
1142A	Gurudas Mukhopadhyay
1144A	A. Ray
1146A	S. Bhattacharya
1151A	Jayanta Kumar Roy
1154A	Kashmir Lal Mallik
1159A	Jiban Chakrabarty
1161A	Ram Chandra Gupta
1165A	Syamal Kumar Basu
1170A	Saroj Kumar Sarkar
1179A	Gobind Chandra Tripathy
1181A	Sadhu Charan Senapati
1182A	Narayan Dash
1187A	Harekrushna Khuntia
1188A	Uma Sankar Guha
1191A	Krushna Chandra Das
1198A	Gadadhar Satapathy
1199A	Neelakantha Das
1203A	Arun Kumar Patra
1205A	K. Vittal Rai
1207A	Krishnaswamy Rajagopalan
1208A	Duryodhana Samal
1209A	Kruttibas Swayin
1210A	Trinath Jena
1211A	Sarat Chandra Patnaik
1218A	Raj Gopal Ahluwalia
1226A	Gopal Krishn
1246A	Babu Ram
1258A	Satya Pal Khurana
1261A	Ram Prakash
1265A	Yash Pal Kapoor
1275A	R. B. Gupta
1276A	Vasudeo Mahadeo Gadre
1290A	Ranjit Singh
1298A	J. C. Grover
1299A	Sarvjit Singh Bhatnagar
1301A	B. S. Bhatnagar
1302A	T. N. Malhotra
1303A	M. G. Bhatia
1304A	Jagdish Narain
1319A	Guranditta Bhatia
1331A	Sunder Lal Gupta
1333A	S. C. Johar
1337A	Man Mohan Mehra
1349A	Om Prakash Goel
1350A	Krishna Chnd
1351A	Dharam Pal Taneja
1356A	Satyender Krishan Bhatia
1359A	Prakash Chand Gupta
1363A	Abhey Kumar Jain
1365A	Prem Parkash Juneja
1368A	V. N. Mathur
1381A	Prem Chandra Gupta
1385A	Harish Chandra
1399A	Rupo Thariani
1416A	Haripal Singh
1417A	D. K. Gera
1422A	Trilok Chand Gupta
1425A	H. B. Ramchandani
1428A	Puravath Kuriakose Varkey
1431A	K. L. Lalchandani
1433A	Ram Gopal Bhatnagar
1438A	Bal Mukand Sharma
1439A	Devinder Singh Bhatia
1458A	Suresh Kumar
1462A	Jainti Parshad Rustagi
1469A	Pritam Singh Arora
1473A	Manohar Lal Adhlakha
1477A	C. Dass
1479A	Rajinder Kumar Bangia
1496A	V. K. Gupta
1512A	Mohan Behari Lall
1513A	Triloki Nath Sharma

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
1514A	K. C. Agrawal
1528A	Brij Bhushan
1544A	Dharam Vir Chaudhry
1559A	B. K. Khullar
1560A	R. Doraiswami
1565A	Madan Gopal Mittal
1566A	G. M. Tolani
1568A	Gopal Singh Bisht
1571A	Ravindra
1574A	Chaman Lal Jain
1575A	J. G. Idnani
1590A	Arjan Dass Gurwara
1596A	Govind Mohan Garg
1599A	Ravinder Lal
1601A	Shrikrishan Gupta
1602A	Jagdish Chandra Pasrija
1605A	M. L. Suri
1608A	Nachhattar Singh Matharu
1620A	S. C. Jain
1627A	Ram Kumar Kalia
1641A	Rajendra Kumar Gupta
1642A	Om Prakash Ahluwalia
1643A	Hirde Narain Bhatia
1647A	Ved Parkash
1650A	Harbans Singh
1656A	Dina Nath Bajaj
1661A	Ramesh Chander Puniani
1663A	K. C. Batra
1664A	Om Parkash Sharma
1667A	Ranjit Lal
1671A	Balbir Singh Budhraja
1682A	Lakian Lal Verma
1710A	Raj Bahadur Singh
1715A	Bharat Bhushan Pahuja
1720A	Rachhpal Singh Samra
1721A	Madanlal Khurana
1722A	V. P. Dawar
1730A	Amal Mohan Bhattacharyya
1731A	S. C. Chakravorty
1737A	D. K. Bhattacharjee
1741A	Biswanath Roy
1746A	Gopal Chandra Gupta
1748A	Tarun Kumar Kar
1751A	Arun Kumar Bhattacharyya
1755A	Amar Nath Ghosh
1759A	Santa Sil Bandhu
1762A	Asta Behari Poreh
1763A	Arabinda De
1767A	Tusharkanti Chakrabarti
1770A	Ram Narain Mehta
1775A	Iswar C. Bhattacharjee
1777A	Prasanta Kumar Goswami
1780A	Vasdev Chaddha
1781A	Daya Nand Gauri
1790A	Mahendra Mohan Goswami
1791A	Rupendra Kumar Sharma
1793A	Srikanta Das
1794A	Gouranga Chandra Mandal
1815A	Angelo Inacio D. Silva
1830A	Nandiraju Krishna Rao
1845A	V. N. Dubey
1851A	Kalagiri Ramireddy
1853A	P. S. Raju
1857A	E. V. M. Krishnamacharyulu
1859A	P. Jacob Koshy
1878A	K. Sambasiva Pillai
1889A	Sohan Singh
1890A	Ramarapu Venkat Rao
1900A	R. Sambasiva Rao
1901A	M. Umamaheswar Rao
1906A	P. V. Subrahmanyam
1907A	A. Paramasivachari
1909A	S. S. Khadri
1910A	V. Krishna Rao
1916A	P. G. Krishna Murtey
1917A	K. R. K. Anjaneyulu
1929A	Kishor Ramchandra Akole
1930A	S. Kallyya Hosmath
1931A	Natesa Srinivasan
1932A	Chellori H. Kumar
1937A	G. K. Srinivas
1948A	P. R. R. Reddy
1949A	C. Harinath
1951A	N. D. Prasada Rao
1967A	K. S Sarma Venkatraman
1968A	Ramesh Kumar Wadhawan
1980A	K. C. Pant
1982A	Shrikrishna Jha
1988A	Ratnakar Vishnu Jogdand
1995A	Hari Chand Khattar

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
2014A	Krishan Dev
2016A	Harvir Singh Rana
2021A	Chandra Prakash Sharma
2036A	Mahendra Singh Sekhasaria
2051A	Gurdeep Singh
2055A	Surendra Kumar Papriwal
2061A	G. Kewalsingh Ahuja
2062A	Nand Kishore Nayyar
2063A	Prabhu Dayal
2066A	V. N. K. Kumar
2086A	Ram Sewak Chaturvedi
2091A	Man Singh Rajput
2092A	Murli Dhar Ahuja
2093A	Bhanwar Singh
2094A	Jagdish Prasad Mehrotra
2108A	Parshottam Das Gupta
2126A	Parshotam Lal Sharma
2138A	R. K. Aich
2145A	Dipak Sengupta
2146A	Pashu Pati Singh
2147A	Radheshyam Gurudiwan
2151A	M. M. Singh
2164A	Om Parkash Gupta
2165A	Uma Shanker Sahai
2168A	Ramamirtham Rajagopalan
2180A	Suraj Prakash Mathur
2184A	Prakash Lal Mathur
2185A	Bhagirath Bangarwal
2186A	Hazari Lal Jangid
2187A	S. S. Gahlot
2189A	Narendra Singh Verma
2196A	M. D. Mirani
2200A	Suraj Prakash Tahnvi
2201A	Mahendra Prasad Sharma
2203A	Nanik Manikmal Manglani
2204A	Shyamroop Chand Bhandari
2205A	B. L. Lohap
2231A	Satish Chandra Gupta
2235A	Brijendra Nath Srivastava
2237A	K. K. Uttam
2240A	Parmeshwar Chandra
2241A	Avinash Chandra
2245A	Jagdish Prasad
2246A	Bhan Prakash
2256A	Ranjit Singh

Roll No.	Name of candidate
2259A	Ramesh Kumar Gupta
2261A	Kuldip Singh Virdi
2272A	Om Prakash Satija
2274A	Surjeet Singh Sethi
2276A	Madan Mohan Govila
2283A	D. P. Srivastava
2284A	R. S. Gupta
2289A	S. C. Srivastava
2292A	Chandra Kishore Dikshit
2295A	Prem Narain Bhatnagar
2303A	Kavilas Ram Yadav
2308A	Surendra Bahadur
2322A	Suresh Chandra Tiwari
2353A	Inder Jit Dua
2355A	Achal Saran Kapur
2358A	N. H. Marali
2359A	Jai Narain Mehrotra
2364A	Gingee Vijaya Raghu
2365A	Raghbir Singh
2368A	Virendra Kumar
2371A	Isher Singh Gill
2373A	V. M. Mahajan
2378A	Prem Narain
2390A	Bala Datt Joshi
2406A	Sudershan Kumar Bharihoke
2408A	S. C. Banerjee
2415A	Padhey Shyam Goel
2416A	Mahendra Singh
2421A	U. V. Sitapati Rao
2422A	Y. Subbarao
2423A	S. Kader Mohiadeen
2430A	Jayanta Kumar Mozumder
2436A	R. Balasubramanian
2441A	R. Venkatesalu
2442A	S. P. Babu Joseph
2445A	Ranipet M. Chandra Muthu
2447A	K. Balasubramanian
2449A	C. R. Gopalarathanam
2453A	Ramaswami Arumuga Gnaniar
2454A	S. Sundararajan
2459A	S. S. Narayanan
2472A	Dhirendra Kumar Biswal
2473A	Nabaghana Mahapatra
2477A	Kantilal Prabhudas Pate
2484A	Panchapakesa Srinivasan

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
2486A	C. Shanmugaperumal
2496A	C. K Balaraman
2502A	Krishnaswamy Venkataraman
2543A	Pottapu Sidda Reddi
2545A	Arjuna Pillai Pitchumani
2551A	V. K. Sahasranaman
2553A	Ali Mohammed Azeez Mirza
2559A	Shyama Narayana Rama Iyer
2568A	R. N. Arora
2575A	Shrivishnu Bhaurao Patil
2581A	V. S. Hardas
2584A	Suresh Raghunath Pingle
2590A	B. Bhimasenkaram
2603A	M. R. Banait
2604A	Arun Pralhad Deo
2618A	C. N. Divakaran
2625A	G. Sambamurthy
2633A	P. Raju
2635A	Kochattu Varghese Jacob
2643A	S. Shanmuganathan
2650A	M. Navasingh
2653A	S. Sethu Raman
2664A	V. Subrahmanya Bhat
2678A	Tersem Lal Bhatti
2679A	Sushil Kumar Puri
2682A	Sardari Lal Lamba
2687A	Charanjit Singh
2688A	A. S. Bhagar
2690A	Kewal Singh
2701A	M. L. Gupta
2706A	Bhupinder Dham
2716A	Sukhjinder Singh Bhatti
2724A	Ram Nath Cheema
2735A	Madan Lal Garg
2741A	Kailash Chand Jain
2742A	Pawan Kumar Singla
2743A	Sarwan Singh
2744A	Y. Sambasiva Rao
2746A	Om Prakash Gulati
2770A	Gian Chand Bansal
2782A	Mahinder Parkash Malhotra
2783A	Jagdish Chander
2785A	Kanwar Singh
2794A	Gurdarshan Singh
2798A	Balbir Shingh Kochhar
2801A	Narinjan Singh Dang
2804A	Surjit Kumar Blassi
2807A	Dev Kumar Gogia
2809A	Tarlok Singh
2810A	Prem Parkash Malhotra
2814A	Dharam Pal Blassi
2833A	Ratan Chand Gulati
2835A	Krishan Kumar Dhir
2836A	Shankar Dass Khepar
2837A	Jaswant Ram Sachdeva
2838A	Chaman Lal
2839A	Sat Saroop Bajaj
2845A	Harpal Singh Ryait
2846A	O. N. Chhabra
2847A	Satish Chander Sharma
2848A	Hans Raj Banga
2853A	Birbal Vindar Pal Singal
2867A	Birbikram Ray
2869A	A. C. Bhattacharya
2870A	Anadi Nath Mukhopadhyay
2871A	Radha Kant Mishra
2874A	Mithila Sharan Singh
2877A	Harendra Singh
2885A	Kanhaiya Lal Kayastha
2890A	Krishna Prasad Mandal
2915A	Mahendra Prasad Sinha
2917A	Brindaban Mohan Ganguly
2936A	Mathura Prasad
2947A	Sia Sharan Singh
2949A	Subir Chandra Sengupta
2956A	S. N. Inamdar
2966A	Sudhakar Shridhar Upasani
2967A	A. K. Vaidya
2968A	N. C. Manik
2972A	Shrikant Laxman Apte
2979A	S. K. Devardekar
3005A	A. P. Deshpande
3014A	K. G. Thomas
3018A	Shankar Bhagwant Belsare
3024A	Vinayak Shridhar Kulkarni
3025A	S. C. Gulati
3027A	K. S. Kale
3037A	Gangadhar Narayan Joshi
3041A	Roshan Lal Tuli
3043A	S. S. Kurdekar

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate	Roll No.	Name of candidate
3052A	D. C. Batta	3209A	Jai Singh
3054A	Ganesh Das Gulati	3216A	D. S. Subramanian
3057A	S. P. Athalye	3219A	Gopal Krishna Pandey
3059A	Harjinder Singh	3221A	T. P. Narayana Pillai
3064A	Pralay Sarkar	3222A	Sudarshan Kumar
3066A	Madhukar Prabhakar Shimpi	3223A	Brij Nandan Tewari
3080A	Om Upkar Nath Nijhawan	3232A	Sebaranjan Pat Joshi
3085A	P. N. Kale	3233A	Sasanka Sekhar Mukherjee
3094A	Arvind Mukund Gokhale	3235A	L. M. Misra
3135A	R. P. Sinha	3240A	G. Singh Bharara
3138A	Ramesh Laxman Balsaver	3241A	Naresh Singh
3141A	V. N. Gupta	3253A	C. D. Poulose
3146A	Gopal Chandra Das	3260A	Kakkadath Soman
3149A	Kamal Saran Shamshery	3261A	P. Bhasai
3151A	Vimal Kumar Jain	3263A	S. S. Subramanian
3153A	Satya Pal	3268A	G. Natarajan
3154A	Dharam Pal Singh Verma	3272A	V. Paramoo
3160A	Sher Singh	3280A	K. A. Sreedharan
3161A	Jogendra Singh	3291A	K. N. V. Nair
3168A	Om Parkash Vij	3301A	V. Kunjuraghvan
3170A	Manik Chandra Garg	3312A	R. Rajagopalan
3172A	Mam Mohan Singh Bhinder	3316A	Govindapillai Gopakumar
3177A	Satish Chandra	3320A	M. K. Kuriakose
3180A	Mahendra Singh	3337A	M. Kalathi Subramanian
3181A	Sudarshan Kumar	3338A	V. S. Pilli
3192A	Amarjit Singh Gulati	3339A	M. Rama Subba Raju
3195A	Ranvir Singh Verma	3342A	Atma Ram Aggarwal
3197A	Dhan Prakash Mittal	3358A	K. V. Gopala Rao
3203A	Kailash Chandra Sharma	3376A	V. Sree Venkateswarlu
3205A	Brij Mohan Singhal	3379A	C Mahalingam

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B

Roll No.	Name of candidate	Roll No.	Name of candidate
7B	A. R. Jayasimha	40B	Brij Bhushan
8B	K. Balasubramanian	47B	Authipudi Nagaraja Rao
10B	Hanumantha Rao Bapu	56B	H. Shivarudraiah
12B	S. R. Raghavendra Rao	57B	V. Narahari Rao
15B	K. S. S. Lakshminarasimhaiah	60B	Sethurao Narasimha Murthy
17B	M. B. Vijayendra Rao	61B	Anoo Raghavendra Rao
19B	S. Krishnamurthy	63B	D. V. Ramachandra Rao
21B	Channakesavapur Rama Rao	64B	D. S. Sripathi
22B	Vasudeva Murthy	69B	Inna Vedavyasa Sharma
32B	V. Sadanandan	76B	H. S. Reddy

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate
81B	Manohar Lal Taneja
82B	Ajit Kumar Singh
84B	Bimalendu Das Gupta
87B	Shri K. M. Ravindran
89B	Shri K. A. Nichani
90B	M. Gopal Reddy
91B	Ram Kumar Govil
92B	Dhurendra Singh Tomar
93B	Sharda Prasad Misra
97B	Amrik Singh
98B	Daya Krishan Arora
101B	Tanappa Nagappa Shaldar
103B	Anant Gopal Tilak
104B	Chandrakant Laxman Phadke
107B	T. O. Varughese
108B	N. M. Vyavaharkar
110B	Shri D. K. Bene
111B	M. S. Ramachandra Rao
112B	A. L. Nadagouda
115B	Shri R. B. Shah
122B	S. A. Kamalapurkar
124B	Shyam Sunder Mulwani
129B	Madhav Pralhad Pandit
131B	Kovoor Mathew Mathew
133B	Manmohan Lall Uppal
136B	M. Narothama Reddy
139B	S. S. Mirajakar
141B	Krishan Lal Garg
143B	Narayanan Kutty Palazhy
147B	Bantwal Vasudeva Somayaji
148B	Yashawant Narayan Patade
149B	Prabhakar Ganesh Marathe
156B	Nagesh Balkrishna Barde
158B	Raghunath Dodhu Wayakole
164B	Cyril Fernandes
166B	Rabindranath Basu
168B	V. S. Prabhakara Rao
169B	Pranay Krishna Mukherjee
175B	Amit Chattopadhya
179B	Sambhu Nath Datta
182B	Suprakash Das Gupta
183B	Bimal Ray
184B	Tara Pada Choudhury
186B	Nirmal Ghosh
196B	Dipendra Nath Chakrabarti
197B	S. N. Lahiri
198B	Shyamal Kant Ghosh
201B	Sant Ram Goyal
202B	B. V. A. Krishna Murthy
206B	Tapash Ranjan Palit
208B	Sankar Maitra
210B	Amal Kumar De
216B	Pabitra Kisor Das
219B	Anil Kumar Hajra
221B	M. Bhattacharyya
222B	Radhanath Das
225B	Pulak Purna Sengupta
227B	Debabrata Ganguly
228B	Milan Kumar Roy
230B	Bireswar Bhattacharyya
231B	Nayan Ranjan Nandy
234B	Susanta Kumar Sinha
235B	Abraham Korah
236B	Sukes Ranjan Mukherjee
237B	Sajal Kanti Basu
238B	Nirmales Nandi
239B	Subhash Chandra Roy
246B	Gagan Behari Nanda
248B	Mihir Kumar Bose
249B	Mulakala Subha Rao
254B	Kannu Charan Nayaka
255B	Radhamohan Patra
258B	Radha Mohan Panda
259B	Dhabaleswar Sahu
261B	Dambarudhar Samantaray
262B	Surendra Nath Naik
264B	V. Narayanan
265B	Bhagabati Prasad Patnaik
267B	Murari Lal Khanna
272B	Kasturi Lal
276B	Nand Kishore Khanna
278B	S. P. Anand
279B	Ved Prakash Jain
282B	Verinder Singh
285B	Vijinder Kumar Jain
287B	Krishna Swaroop Kapoor
294B	Priya Ranjan Sircar
295B	Gopal Dass Makkar
299B	Rajendra Chandra Mathur
300B	Devi Charan Dubey

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate
306B	Jagdish Prasad Gupta
307B	Thakar Das Sachdeva
308B	Abnash Singh
313B	S. K. Khanna
315B	Harbans Lal Kohli
317B	Shiv Darshan Kumar
318B	Phool Chand Jain
319B	Gobind V. Kalwaney
321B	Krishna Swarup Saxena
324B	Pritam Lal Mehta
327B	Daya Nand Agarwal
331B	Jagdish Chander Malhotra
332B	Gulab Bhambhani
333B	Kishan Chand
334B	V. D. Gandotra
342B	Jagdish Rai Bhasker
345B	Sewa Ram Dua
346B	K. C. Gambhir
347B	Balbir Singh Bhatti
349B	Manindra Bhusan Roy
351B	Baldev Raj
352B	Narendra Kumar
354B	Satya Paul
355B	Y. D. Tawakley
357B	Prem Narayan Sharma
360B	Madan Lal Gupta
361B	Ram Sarup Bajaj
362B	Raj Kumar Chandna
363B	Rajendra Nath
364B	S. L. Bhasin
366B	Om Parkash Bhatia
369B	S. S. Yadav
370B	Kailash Chandra
372B	Saroj Kumar Chattopadhyay
373B	S. C. Bhattacharyya
375B	B. N. Chatterjee
376B	Sumran Lal Garg
377B	Achinta Kumar Sikdar
378B	S. Kuriakose
379B	M. C. Vaidya
380B	Hari Narain Goel
385B	A. Abdurrasul Kazi
387B	J. H. Sambrani
389B	Anne Radha Krishna Rao
391B	Gudur Rosi Reddy
394B	Appikatla Punna Rao
395B	L. Janakiram
398B	Gungi Srinivasachar
399B	Mohammed Fazaluddin
400B	K. Venkatachalama Reddy
401B	Mandalapur Venkateswarlu
402B	N. Venkatarama Sastry
403B	Boddipalli Appalanaidu
406B	Dwarapu Gopal Rao
407B	Busetty Raghavendra Gupta
408B	Nukala Ramachander Rao
410B	Venkatarama Ramamurthi
411B	S. Ghouse Khan
412B	Chavali Dayakara Rao
413B	Md. Lateefuddin
415B	Pulta Rajendra Prasad
417B	Chapala Sesha Reddi
421B	U. Satyanarayana Murthy
423B	K. R. G. M. Anil Kumar
425B	Divakarumi Bhaskara Babu
426B	Kante Suryachandra Rao
427B	Hebbar Krishna Sarma
428B	B. G. Sarode
429B	Rupanagudi Sreesailm
431B	Subbarayappa Shamanna
435B	P. Ramana Reddy
436B	Raiz Mirza
437B	Madhukar Vaman Khadilkar
438B	Panju Lakshmanan
442B	Krothapalli Mohan Prasad
443B	Md. Khalilul Huq
445B	Y. Jagannadham Chetty
446B	M. Gopala Krishnam Raju
447B	R. B. J. R. Krishna Prasad
448B	Chejarla Konda Reddy
450B	Gude Santha Rao
454B	Pattisapu Someswara Rao
455B	Korupolu Rama Rao
456B	K. M. Reddy
457B	S. Madhusudhan Rao
460B	Swarna Sambasadasiva Rao
462B	Jashty Sivannarayana
468B	Bendapudi Radhakrishna
472B	S. D. Deshmukh
473B	Kaliash Chandra Mathur

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate
475B	Bhola Nath Nayak
477B	P. D. Deshpande
482B	H. V. Prathapa Simha
483B	Jot Ram Marwal
485B	P. S. Sirohi
486B	Sukul Kumar Pyne
487B	Satya Deo Saxena
489B	Girdhari Lal Garg
493B	Ragam Sambasiva Rao
494B	Manoranjan Sarker
497B	Vellore Pedamba Raj
500B	R. P. Seth
502B	Jyoti Prakash S. Mathur
503B	Tulsi Das Goldsmith
507B	Shreepati Singh Yadav
508B	Mahendra Kumar Gupta
512B	Rama Kant Dwivedi
515B	Swayam Prakash
517B	Prahlad Chandra Mathur
519B	Shamsul Haque Alvi
522B	Devendra Swarup Garg
524B	Lakshmi Narayan Yadav
529B	Lakshmi Shanker Bajpai
531B	Gurcharan Dass
532B	Yog Dhian Adlakha
533B	R. K. Sharma
535B	Munna Lal
538B	Bir Bhanu Singh Bhadauria
542B	Ram Swarup Mitra
543B	Harsh Dev Gupta
548B	Chandra Shekhar Chaudhary
550B	Surendra Kumar Saxena
551B	Mohd. Abdul Gaffar
554B	S. Sreevivasulu Reddy
555B	S. Neervannan
560B	Neelamegham Balakrishnan
563B	K. Aaron
566B	Venkatarao Dhruvan
568B	N. S. Venkateswarlu
574B	Pothuru Satyanarayana
575B	Ramanatha Krishnamurthy
576B	D. G. Chowdary
578B	Sankariyer Balasubramania
580B	K. S. Krishnasamy
584B	Ramachandran Padmanabha

Roll No.	Name of candidate
585B	M. Subramanian Nagarajan
586B	C. Somasundaram Vittal
587B	J. I. Ramachandran
588B	Akella Ramamurti
591B	Nott Raghunathan
599B	K. N. Ramalingam
600B	T. Gajaraj
603B	V. D. Selevaraj
613B	Ashok Shankar Mavinkurve
615B	S. S. Deshmukh
618B	Krishnamurthy Sankaran
619B	Quazi Syed Ahsanuddin
620B	Mohan Pribhdas Gurnaney
621B	S. V. Khandewale
622B	Vittal Ramkrishna Bhat
624B	A. V. Rajagopala Adiga
628B	Raghbir Nath Handa
631B	Joginder Singh
632B	Bodh Raj Gupta
637B	Dev Datt
638B	Amarjit Singh
639B	Yog Raj Sekhri
649B	Jagjit Singh
651B	Naresh Chand Singal
656B	Lakshmi Narain Ojha
657B	Yesh Pal Singh
661B	Ram Janam Sinha
664B	Awdheshwar Prasad
665B	Rajib Ranjan Prasad Sinha
667B	Md. Mazhar Hussain
668B	Surya Narayan Sinha
678B	Ram Lagan Sinha
681B	Indu Bhushan Prasad Singh
682B	P. T. Kochumathew
684B	Manabendra Roy
686B	Gangadhar Govind Kelkar
689B	J. D. Karandikar
693B	Satya Murtie Jain
695B	Vasant Narayan Chaudhari
698B	Gajanan Narayan Gundi
700B	Waman Vishnu Adkar
702B	Uday Shankar
703B	T. R. Krishna Swamy
706B	R. K. Sen Choudhury

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of Mandidate	Roll No.	Name of candidate
708B	Ratindra Swarup Mital	746B	P. V. Subramonia Pillay
710B	Amar Singh	749B	Krishnaiyer Sankararama
711B	Som Prakash Kaushish	752B	Ponn Thumby Samuel
717B	G. Singh	756B	Koka Mangapathi Rao
719B	Kunwar Giri Raj Singh Jai	760B	Palepu Venkata Rao
720B	Gopal Charan Das	762B	Batreddi Pandu Ranga Rao
721B	Raj Gopal Arya	763B	T. Sathya Rama Das
722B	Rajaishwar Dass Jain	764B	B. Gangadhara Setty
723B	Sanapala Apparao	768B	Gokavarapu Sriramamurti
729B	Sasanka Sekhar Giri	772B	Emani Ramaiah
732B	Jawahar Lal Koul	781B	M. V. Joga Rao
742B	Raman Dharmapalan	786B	K. R. Chitti Bapu
743B	C. H. Krishnan	788B	T. G. Thulasi Reddy

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A

(New Scheme)

Roll No.	Name of candidate	Roll No.	Name of candidate
13NA	Bhagwat Swarup	918NA	M. Kuppuswamy
29NA	Santam Singh Lamba	923NA	H. Samtani
65NA	K. Chandrashekhara Shetty	935NA	H. R. Sethumadhavachar
109NA	M. Purushottama	946NA	V. K. Agrawal
117NA	V. K. Ravindran	950NA	Bimal Kanta Ray
129NA	V. Narasimha Murthy	976NA	H. C. Dhingra
143NA	K. V. Manjanatha	983NA	M. D. Bhasale
166NA	K. P. C. Sankaran	1010NA	Atma Singh Sabar
204NA	H. Khavekar	1037NA	S. A. Khan
205NA	K. L. Sethi	1103NA	Gope H. Hargunani
276NA	M. K. Abdulla Kunhi	1215NA	Ram Ratan Joshi
282NA	S. Srihari	1236NA	R. N. Basu
299NA	K. Subba Raju	1259NA	A. K. Ray
350NA	S. P. Lakshminarasimhan	1274NA	Yogendra Kumar Sharma
394NA	B. S. Sudhakara Rao	1320NA	Pranab Kumar Datta
426NA	P. V. Siva Rao	1360NA	D. G. Chattoraj
571NA	Yudhisthir Sharma	1378NA	Shri Jyotsna Kant Ghosh
585NA	L. C. Khatri	1398NA	Dulal Chandra Chakraborty
596NA	B. S. Nayak	1406NA	Samir Kumar Seal
606NA	Shyam Sunder Patel	1445NA	B. Bhattacharya
611NA	Raj Kumar Sharma	1528NA	B. S. Rajan
761NA	Gopal Singh	1563NA	Satadal Chatterjee
780NA	N. P. Soni	1625NA	Sivaji Sen
817NA	Om Parkash Mendiratta	1767NA	Swapan Kumar Basu
892NA	Suresh Dutta Tyagi	1815NA	Md. Hasan Imam
900NA	U. K. Thengodkar	1851NA	Shyam Sundar Banik

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
1974NA	Shri Digambar Garanaik
2024NA	B. C. Samal
2043NA	Ranjit Kumar Behera
2046NA	Arun Charan Parida
2061NA	J. Jacob
2145NA	T. R. Gupta
2163NA	Shri Naresh Kumar
2175NA	V. Kumar
2193NA	Gurnam Singh Mehta
2312NA	G. L. Arora
2329NA	B. Singh
2343NA	Rabinder Singh Khurana
2350NA	S. H. Singh Bumra
2354NA	Bhagwan Dass Agarwal
2420NA	Ashok Kumar
2436NA	Satish Kumar Gupta
2592NA	M. S. Negi
2925NA	T. K. Roy
3188NA	S. V. S. Rao
3189NA	K. V. Simhachalam
3216NA	K. Manikyam
3217NA	C. R. Nagaraja Rao
3228NA	M. Innaiah
3238NA	Mahendra Kumar
3245NA	K. V. Raju
3250NA	V. A. Ramulu
3252NA	K. Rajaveeru
3265NA	Raj Kumar Bhandari
3285NA	V. A. Mulay
3290NA	M. Pitchi Reddy
3327NA	M. Madhusudhanarao
3412NA	L. Sambhuprasadareddy
3415NA	P. S. Ramaiah
3490NA	J. K. Sond
3547NA	Baboo Ram
3691NA	Satnam Singh
3737NA	Ram C. Tewari
3761NA	Rajendra Prasad Singh
3762NA	Bhim Singh Gupta
3768NA	B. Vaidhyanathan
3771NA	Balram
3802NA	C. Suryanarayana
3864NA	D. S. Mayer
3886NA	Harish Chandra Gupta
3929NA	B. L. Kaul

Roll No.	Name of candidate
3947NA	S. K. Gupta
4051NA	Naresh Behari Lal
4115NA	V. K. Shandilya
4165NA	V. Ramachandran
4193NA	Sarvesh Kumar
4244NA	Divakar Avasthi
4309NA	R. D. Chaturvedi
4328NA	Kedar Nath Gupta
4372NA	Shikher Chandra Jain
4388NA	P. Gangadhara Reddy
4390NA	Shri Pitambbar Prusty
4391NA	Shri K. Sethuraman
4394NA	Sadananda Nayak
4408NA	R. Uppill
4410NA	L. Sahoo
4413NA	D. Satpathy
4415NA	K. B. Mohanta
4416NA	A. C. Sahoo
4418NA	D. Mahapatra
4421NA	S. Krishnamurthy
4422NA	A. Somasundaram
4427NA	Shri M. Sivasubramanian
4432NA	K. Narasimhan
4435NA	Ashok Kumar Mohan Bakshi
4447NA	K. Kailasam
4448NA	D. Tripathy
4451NA	S. Balakrishnan
4475NA	N. Padmanabhan
4497NA	A. K. Shivaswamy
4517NA	Vijas Kumar Jain
4523NA	A. V. Ramasamy
4525NA	Baidyanath Dutta
4535NA	Chittaranjan Das
4548NA	N. Varadharaj
4554NA	P. A. Subramanian
4567NA	Rajagopala Ramakrishnan
4587NA	Shri K. N. Velayutham
4600NA	B. Ramakrishnan
4608NA	G. S. Naidu
4609NA	V. V. Ekambaram
4618NA	S. Mahadevan
4645NA	P. Sahu
4646NA	Nataraja Ramachandran
4669NA	R. Sreenivasan
4705NA	K. G. Balasubramanian

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
4713NA	K. Ashoke Kumar
4750NA	N. P. Ramaswamy
4753NA	P. M. Rajagopalan
4754NA	M. Chandramohan
4768NA	K. M. Pillai
4789NA	M. G. Vedavyasachar
4838NA	Pundlik Maruti Deshmukh
4951NA	C. N. Thiagarajan
4963NA	Venkataraman Subramanian
5003NA	M. Natarajan
5015NA	V. Ramaswamy
5034NA	V. Sundararaman
5036NA	P. C. Sukumar
5048NA	I. Kalyanasundaram
5087NA	Kulwant Singh
5114NA	M. S. Sidhu
5122NA	Hari Nand Gakhar
5137NA	Ramji Dass Sehgal
5138NA	Lachhman Singh
5143NA	Prem Dyal Sharma
5165NA	Rashpal Singh
5192NA	Raj Kumar Rajput
5194NA	Ved Kumar Manchanda
5211NA	Pawan Kumar Sarwal
5216NA	Jai Singh Roodkee
5293NA	Kasturi Lal Arora
5297NA	Darshan Kumar Sooden
5335NA	Jagdish Chander Gandhi

Roll No.	Name of candidate
5372NA	Surinder Kumar Jindal
5587NA	Salekchand
5604NA	R. Mavullayya
5614NA	B. L. Yadav
5625NA	Raman Beharie Lall
5647NA	C. S. K. Gupta
5687NA	Bishram Sinha
5710NA	Jagmohan Singh Chhatwal
5816NA	S. B. Patil
5850NA	Jasbir Singh Dham
5952NA	P. V. Pathak
6001NA	Surendra Prasad Singha
6055NA	R. K. Gupta
6094NA	A. Singh
6112NA	V. P. Singh
6124NA	Ved Prakash Bali
6125NA	Sudhir Kumar Goyal
6208NA	Asok Kumar Pal
6339NA	P. K. B. Nair
6360NA	B Venkata Raman
6379NA	C. V. Uthuppunny
6393NA	C. S. R. Nair
6428NA	K. P. Ramachandran Nair
6468NA	A. J. Rao
6483NA	D. Suryanarayana Raju
6506NA	Nattey Paparao
6507NA	J. Venkata Rao

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B

(New Scheme)

Civil

Roll No.	Name of candidate
4NB	Rishi Bhushan Gupta
8NB	Kodihalli Thammaiah
15NB	B. A. S. Rao Keshava Murthy
17NB	Sri Sai Das
29NB	P. S. Kumaraswamy
51NB	Prem Nath Garg
55NB	S. Parameswara Iyer
63NB	S. K. Wadhwanwalla
78NB	D. M. Mahajan
99NB	John Mathew
106NB	Ram Sri Bhattacharyya

Roll No.	Name of candidate
109NB	Satiranjan Goswami
137NB	G. S. Bhattacharjee
140NB	Debraj Mohapatra
155NB	Rasananda Swain
164NB	Bibhuti Bhusan Rout
177NB	Amar Nath
185NB	A. K. Syngle
188NB	Jas Pal Singh
233NB	H. K. Kulshrestha
242NB	Labh Chand
253NB	Radheyshyam Sethy
271NB	Kharaiti Lal Bajaj

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate
278NB	Shri Mohan Lal Goyal
308NB	Ravi Prakash Agarwal
310NB	Dharam Paul Goel
316NB	Satish Kumar Kohli
325NB	Ram Datta Sah
326NB	Harinder Singh Ratra
353NB	Chennupaty Krishnamurthy
379NB	Sajja Venkateswara Babu
384NB	M. Gopalkrishna Murty
407NB	Y. Venkatasubbaiah
413NB	Namasivayam Sivagurunatha
430NB	B. R. Kohli
431NB	Hakumat Rai Luthra
437NB	Jai Kishan
472NB	Narendra Kumar Gupta
474NB	Ram Awatar Malvia
528NB	Santosh Kumar
699NB	Bhagwati Prasad Shrivasta
745NB	N. P. Mustafa
752NB	A. Yacob Kochukunju
753NB	P. Narayana Pillay
754NB	K. Madhavan Pillai
755NB	V. E. Vamanan Namboodiri
761NB	Karikkanthara K. Divakaran
768NB	T. Venkata Kameswara Rao

Mechanical

811NB	M. Muniswamy
812NB	L. Lakshminarayan
824NB	B. Sitaramaiah Dattatri
832NB	Glynn Philip Bolar
870NB	Shri Achal Kumar Datta
974NB	Baldev Singh Harish
1003NB	D. A. Pardasani
1014NB	Muthuswamy Venkatachalam
1031NB	Bhogaraju Satyanarayana
1037NB	Saripally John
1052NB	V. V. R. Subuddhi
1065NB	Vinod Kumar Sharma
1076NB	Annathorai Venkataraman
1111NB	Krishnamaraja Ramchandran
1118NB	A. S. D. Money
1119NB	K. Subramanian
1120NB	T. R. Ramadurai
1132NB	Chintamani Jaganath
1173NB	Nand Lal Singla
1228NB	C. Atchyutarama Rao
1659NB	Asoke Roy

Electrical

1253NB	M. V. Venkateshananda Kumar
1258NB	P. S. Raghavendra
1259NB	Nampurath Krishnan Kutty
1284NB	Shyam Sunder Guglani
1290NB	Ram Singh
1305NB	Nachhattar Singh
1307NB	Krishan Chand Singla
1310NB	Gurmit Singh Grewal
1328NB	Subramanya Jayaraman
1354NB	Subodh Ranjan Sen Gupta
1361NB	Dilip Kumar Mukherjee
1367NB	Adhiraja Mohana Senapaty
1429NB	V. Venkateswara Rao
1485NB	S. Narayan Nafde
1490NB	N. P. Rajendran
1493NB	G. Lakshminarayanan
1506NB	Naranjan Lal Shahi
1538NB	Bhagwat Pershad
1563NB	K. A. Venkatarama Setty
1564NB	P. Muthuswami
1568NB	P. V. Chacko
1572NB	Ramidi Venkata Subba Rao

Chemical

1578NB	Balraj Kumar Trehan
1588NB	A. A. Ramakrishnan

Metallurgical

1594NB	H. S. Ramachandra
1597NB	Krishan Parkash Chopra
1598NB	N. K. Mondal
1610NB	Sunit Kumar Banerji
1614NB	Upkar Singh
1617NB	Subhash Chandra Gandhi

Electronic and Telecommunication

1632NB	L. C. Manoharan
1637NB	Anil Bhushan Mukherjee
1643NB	Baidyanath Bhattacharjee
1647NB	K. V. S. Malikharjuna Sarma

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column, a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

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" . I find that it is a very useful work nicely brought out and will be of immense help to staff and officers in the P.W D. and go a long way to minimise audit objections if properly made use of". Md. Usman, Addl. Chief Engineer, Hyderabad.

" . . . There is one chapter among others dealing with 'Duties of Overseers' in this book which will be very useful to young Engineers as well as Overseers" S. N. Gupta, Chief Engineer, West Bengal, Calcutta.

" .. I feel that it will be found very useful by new entrants to the P.W.D. as Overseers, etc., in discharging their duties satisfactorily by avoiding the common irregularities usually committed in the maintenance of initial accounts". P. Sirajuddin, Chief Engineer, Madras.

" ...It is quite a nice book explaining the basic principles of P.W. Accounting, which is useful for all those who are engaged in Engineering activities and particularly for engineering students." K. M. Joshi, Chief Engineer, Mysore.

" . . . In my opinion, this book is valuable for all young officers, not only Overseers but Asstt. Engineers and young Executive Engineers as it will give them a better understanding of the account problems of a P.W.D. Work Divn." S. N. Sinha, Addl Chief Engineer, P W.D., Bihar.

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The Council has directed that hereafter all payments to the Institution shall **only** be made :

(1) by demand draft drawn on a Calcutta bank or by cheque sent by post (70 p. being included as bank charges in the case of an outstation cheque);

(2) in cash tendered at any branch in India of the State Bank of India along with bank-cards A and B;

(3) in cash, cheque or demand draft deposited at the cash counter of the office of the Institution Headquarters in Calcutta; and

(4) by postal order to a maximum of Rs. 10 for the cost of publications and Studentship application registration fee only.

Please note that any payment by money order or by postal orders other than as mentioned in (4) above cannot be accepted.

ADVERTISEMENTS IN THE INSTITUTION'S PUBLICATIONS

Members are well aware that the existing inflationary conditions compel the Institution to seek every possible means to supplement its income in order to combat the rising costs, so that the services to its members and the engineering profession as a whole will not only be maintained but expanded. Costs have particular validity when the Institution's publications are concerned, the scale and scope of which are unprecedented for any organization in this country.

The Headquarters, therefore, consider it necessary to do all they rightfully can to increase the quantity of advertisements in the publications. A greater number of advertisement pages would be of real help in offsetting some of the expenses of the publications.

It is stressed that the Journal in all its Parts, the Bulletin and the Year-Book have also a large circulation overseas and suitable advertisements in them can materially aid the present drive to the export more of India's engineering products. There is also great scope for advertisements of the products and equipment supplied by constructional, light engineering and ancillary industries, and for firms whose goods and services will appeal to members as individuals. The Headquarters believe that these publications are most attractive media for this type of advertisement and that many members connected with firms would be glad to use this means of publicizing their activities. Also, as increasing proportion of commercial and executive positions in industrial, contracting and public organizations become occupied by professional engineers, so do the publications reach more and more to those to whom engineering advertisements are directly useful.

Members whose positions enable them to help the Headquarters in this effort are requested to bring to the notice of publicity managers the merits of the Institution's publications as channels for reaching purchasers of engineering equipment. A brochure giving full particulars of rates and other information may be obtained from the Technical Officer (Scientific) at the Headquarters at 8 Gokhale Road, Calcutta 20.

Form 362

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

November 1965 Examinations (Old Scheme)

General information and instruction to candidates

(Approved by the Examinations Committee, 51st Meeting, Resolution 21, 30th December, 1958)

(Revised by the Examinations Committee, 57th Meeting, Resolution 19, 27th-29th June, 1961 ; and 58th Meeting, Resolution 10, 13th and 14th October, 1961).

(1) The next Studentship and Associate Membership (Sections A and B) Examinations will be held from Monday, November 8, 1965 to Tuesday, November 16, 1965, excluding Sunday, 14th, and Tuesday, November 9, 1965. The application forms for the Associate Membership (Sections A and B) Examinations and the programme of examinations are attached to this *Bulletin*.

(2) **All applications accompanied by examination fees for admission to the November 1965 examinations should reach the Head Office before 4 p.m. on Wednesday, September 15, 1965.** Examination fees once paid are neither refundable nor transferable to a subsequent examination or to any other account. Receipt of examination forms will not be acknowledged by the Head Office, unless accompanied by a self-addressed post-card.

(3) **Examination fees should be preferably deposited at the State Bank of India in the candidates' locality. Attention of the candidates is specially drawn to item 3 in Form 304 (rev. 8) and item 4 in Form 305 (rev. 7) in this regard. The instructions for making such payment are given in card A (attached herewith) and on its reverse. Other modes of payment may be used only if this is not possible. Payment of examination fees by cheque, postal orders or money order will not be accepted.**

Mention the code number as given in the top of the application form in the bank card.

(4) No application for a change of examination centre will be entertained after 4 p.m. on Wednesday, September 15, 1965.

(5) Students who are in arrears of subscription will not be admitted to the examinations.

(6) **The Institution reserves the right to reject incomplete or illegible applications without any reference to the candidate.**

(7) No Student will be permitted to appear in Section A or B examination unless he has secured exemption from appearing in at least one subject of Section A or B examination.

(8) A candidate who has already passed the Section A and B examinations or is exempted therefrom will be permitted to appear in any paper or papers of Section A and/or Section B on payment of an examination fee of Rs. 30.00 per paper. The details of passing the Section A and B examinations or of exemption therefrom should be clearly stated in the examination form, with the grade of membership.

(9) The paper in 'Engineering Drawing II' is of 5½ hours' duration, with a one-half hour recess between. Candidates will not, however, be permitted to leave the examination hall.

(10) Section B candidates should specially note to write down on the cover of their answer-books of the papers in 'Engineering Drawing I and II' the names of their particular sections, *viz.*, structural steelwork or reinforced concrete or machines or electrical or chemical plant.

(11) **Candidates are not permitted to use handbook(s) for the paper in 'Engineering Drawing II.' They may however use steel tables of the Dorman-Long type.**

(12) Candidates detected using unfair means in the examination hall will be expelled from the Institution and will not be readmitted to the Institution at any future time.

(13) Candidates reappearing in subject(s) in which they have already secured exemption(s), will have their paper(s) cancelled. The previous exemption(s) will stand.

(14) It is sometimes found that candidates do not enter their Studentship Number/Studentship Application Reference Number, Roll Number, or other necessary particulars on the answer-books. Such answer-books will be rejected and no attempt will be made to locate the candidates. Candidates should therefore take particular care to write down these particulars on the answer-books correctly.

(15) **The results of the November 1965 examinations will be declared before the last day of February 1966.**

(16) Candidates will be permitted to apply for the checking of their answer-books as to whether the marks allotted in the answer-books were added correctly and all the answers within the answer-books were appropriately marked, on payment of Rs. 5 as checking fees for each paper. Candidates wishing this check to be made should apply to the Controller of Examinations within 15 days of the date of posting the results by him.

(17) The marks of each examination will be communicated to candidates along with results free of charge.

(18) **The Institution reserves the right to cancel the result of any candidate without assigning reasons, in which case, the marks will not be supplied.**

(19) In any future correspondence in regard to the November 1965 examinations, candidates should always mention the Section of the Associate Membership Examination in which they appeared and their centre of examination in November 1965.

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

November 1965 Examinations (Old Scheme)

Programme

Days	S.T. 10.00 to 1.00	S.T. 2.00 to 5.00
	Studentship Examination	
Monday, November 8, 1965	English	Mathematics I
Wednesday, November 10, 1965	Mathematics II	Physics
Thursday, November 11, 1965	Chemistry	
	Associate Membership Examination—Section A	
Monday, November 8, 1965	Mathematics I	Mathematics II
Wednesday, November 10, 1965	Applied Mechanics	Principles and Applications of Heat, Light and Sound
Thursday, November 11, 1965	Principles and Applications of Electricity	Theory of Structures and Strength of Materials Theory of Machines Elementary Electrical Engineering Applied Chemistry Physical Chemistry and Organic or Inorganic Chemistry
	Associate Membership Examination—Section B	
Monday, November 8, 1965	Engineering Materials	Engineering Drawing I
Wednesday, November 10, 1965	Engineering Drawing II (from 10.00 a.m. to 1.00 p.m. and 1.30 p.m. to 4.00 p.m.)	
Thursday, November 11, 1965	Theory and Design of Structures Diffusional Processes, Evaporation and Distillation Chemical Works Organization and Management	Electrical Engineering General Geology Fuels and Combustion
Friday, November 12, 1965	Irrigation Water Supply and Sanitary Engineering Hydro-Electricity Agricultural Engineering Machine Design Mining Metallurgy Mechanics of Fluids	Thermodynamics and Heat Engines Metallurgy Transport and Storage of Materials Principles of Heat Transmission and Furnaces Soil Mechanics and Foundation Engineering
Saturday, November 13, 1965	Workshop Technology Engineering Chemistry Electrical Installations Electrical Measurements Electric Traction Ultra-High Frequency Technique Including Radar and Centimeter-Waves Electro-Chemistry Industrial Stoichiometry	Building Construction Stability and Resistance of Ships Gas Engineering Principles of Mining Metrology and Machine Tools Electricity Supply Instruments and Automatic Control in Chemical Industry Chemical Works Design and Construction Size Reduction, Mixing and Separation
Monday, November 15, 1965	Hydraulics and Hydraulic Machinery Roads Town Planning Harbours and Docks Architecture Line Communication Railways Power Generation and Distribution in Chemical Works	Electrical Machinery Geodesy Radio Communication Principles of Heat Transmission, Heat Transfer Equipment, and Refrigeration Materials and Mechanical Construction of Chemical Plants
Tuesday, November 16, 1965	Industrial Engineering and Management	Refrigeration and Air-Conditioning Aeronautics

1. I appeared in previous Section B Examination(s) and the details of exemptions obtained are given in the table below.
2. I wish to appear in the Section B Examination (Old Scheme) in November 1965 in the subjects shown in the table below.

Section B Subjects	Details of exemptions already secured in previous Section B examinations		Subjects in which it is desired to appear in November 1965†
	Month and year of examination	Roll Number in that examination	
Compulsory (1) Engineering Materials			
(2) Engineering Drawing I			
(3) Engineering Drawing II			
Optional Group No. (a)			
(b)			
(c)			

† Please write 'Yes' against the subjects in which you desire to appear in November 1965

Name ....

Studentship No. ....

Code 13

(Mention this Code No. in the bank card.)

See notice under 'Institution Notices' of the *Bulletin* for eligibility to appear in the OLD SCHEME

Form 305 (rev. 7)

B

THE INSTITUTION OF ENGINEERS (INDIA)

8, Gokhale Road, Calcutta 20

November 1965 Examination (Old Scheme)

Application for Section B Examination

Strike out whatever is not applicable.

(1) I have already passed the Section A Examination, completing it in the month and year ....when my Roll No. was ... .

(2) I am exempted from the Section A Examination, *vide* letter no ....dated.............. .... from the Secretary, The Institution of Engineers (India).

*(3) I wish to appear in the Section B Examination (Old Scheme) in Novembe 1965 at

1.	(Give in order o preference)
2.	
3.	

The places where the examination will be held are :

1. Agra
2. Ahmedabad
3. Bangalore
4. Baroda
5. Bhagalpur
6. Bhilai
7. Bhopal
8. Bombay
9. Calcutta
10. Chandigarh
11. Cuttack
12. Delhi
13. Durgapur
14. Gauhati
15. Hubli
16. Hyderabad
17. Jabalpur
18. Jaipur
19. Jamshedpur
20. Jodhpur
21. Kharagpur
22. Lucknow
23. Ludhiana
24. Madras
25. Mysore
26. Nagpur
27. Neyveli
28. Patiala
29. Patna
30. Poona
31. Ranchi
32. Roorkee
33. Rourkela
34. Sindri
35. Srinagar
36. Trivandrum
37. Visakhapatnam

(4) I have deposited Rs. 50.00 into the State Bank of India .... Branch.......................... ....on................................ as examination fee, and enclos card A herewith.

(city or town)

(*This method of payment is preferred.*)

(5) I enclose bank draft No.......................dated.. ....for Rs. 50.00 on a Calcutta Bank as examination fee.

(6) I have deposited Rs. 50.00 by cash at the cash counter of the Head Office as examination fee on................................

(8) **Admission Card and Result of November 1965 examination will be sent to the address, as registered by the candidate in the Institution Head Office.**

Full name.................. ....
(in block letters) (Surname) (Others—Please give expansion of your initials only.)

Signature............................. .... dated.. ....

Studentship No..

Local Centre... ....

Attestor's name.. ....

Membership/Associate Membership No. ....

*See notice under 'Institution Notices' of the *Bulletin* before filling the Form.

P.T.O.

1. I last appeared in the Section A Examination (Old Scheme) in ....196 , with Roll No. ....

2. I wish to appear in the Section A Examination (Old Scheme) in November 1965 in the subjects shown in the table below.

Section A Subjects	Details of exemptions already secured in previous Section A examinations		Subjects in which it is desired to appear in November 1965*
	Month and year of examination	Roll Number in that examination	
Compulsory †1. Mathematics I			
†2. Mathematics II			
3. Applied Mechanics			
4. Principles and Applications of Heat, Light and Sound			
5. Principles and Applications of Electricity			
Optional Any one of the following (*Select one and strike out the rest*) 6. Theory of Structures and Strength of Materials			
7. Theory of Machines			
8. Elementary Electrical Engineering			
9. Applied Chemistry			
10. Physical Chemistry and Organic or Inorganic Chemistry			

***Please write 'Yes' against subjects in which you desire to appear in November 1965.**

†Candidates who have secured exemption in Mathematics earlier are eligible for exemption from both Mathematics I and Mathematics II papers.

Name...

Studentship No. ....

Code 12

(Mention this Code No. in the bank card.)

See notice under 'Institution Notices' of the *Bulletin* for eligibility to appear in the OLD SCH

Form 304 (rev. 8)

A

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

November 1965 Examination (Old Scheme)

Application form for Section A Examination

Strike out whatever is not applicable

(1) I appeared in previous Section A Examination (Old Scheme), and the de of exemptions obtained are given in the table on the reverse.

*(2) I wish to appear in the Section A Examination (Old Scheme) in November 19

1. ....
2. ....
3. ....

(Give in orde preference

The places where the examination will be held are :

1. Agra
2. Ahmedabad
3. Bangalore
4. Baroda
5. Bhagalpur
6. Bhilai
7. Bhopal
8. Bombay
9. Calcutta
10. Chandigarh
11. Cuttack
12. Delhi
13. Durgapur
14. Gauhati
15. Hubli
16. Hyderabad
17. Jabalpur
18. Jaipur
19. Jamshedpur
20. Jodhpur
21. Kharagpur
22. Lucknow
23. Ludhiana
24. Madras
25. Mysore
26. Nagpur
27. Neyveli
28. Patiala
29. Patna
30. Poona
31. Ranchi
32. Roorkee
33. Rourkela
34. Sindri
35. Srinagar
36. Trivandrum
37. Visakhapatnam

(3) I have deposited Rs. 50.00 into the State Bank of India, ... Branch .... on ....
(city or town)
as examination fee, and enclose card A herewith.

(*This method of payment is preferred.*)

(4) I enclose bank draft No. .... dated .... for Rs. 5 on a Calcutta Bank as examination fee.

(5) I have deposited Rs. 50.00 by cash at the cash counter of the Head O as examination fee on ....

(6) Admission Card and Result of the November 1965 examination will sent to the address, as registered by the candidate in the Institut Head Office.

Full name ....
(in block letters) (Surname) (Others—Please give expansion of your initials o

Signature .... Dated ....

Studentship No. ....

Local Centre ....

Attestor's name ....

Membership/Associate Membership No. ....

* See notice under 'Institution Notices' of the *Bulletin* before filling the Form.

P.T.O.

A

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

November 1965 Examination (Old Scheme)

EXAMINATION CENTRE CHECK

.... CENTRE

Name..
(in block letters) (Surname) (Others—Please give expansion of your initials only.)

Studentship No. ....

Roll No.. ....
(not to be filled by the candidate)

Section A subjects	Subjects in which it is desired to appear in November 1965*
Compulsory 1. Mathematics I	
2. Mathematics II	
3. Applied Mechanics	
4. Principles and Applications of Heat, Light and Sound	
5. Principles and Applications of Electricity	
Optional Any one of the following *(Select one and strike out the rest)* 6. Theory of Structures and Strength of Materials	
7. Theory of Machines	
8. Elementary Electrical Engineering	
9. Applied Chemistry	
10. Physical Chemistry and Organic or Inorganic Chemistry	

**Please write 'Yes' against the subjects in which you desire to appear in November 1965.*

Signature of the attestor ....

Membership/Associate
Membership No. ....

Designation ....

Full address ....

....

Date.. 1965.

A copy of the candidate's photograph should be pasted here. The attestor is requested to place his signature partly covering this photograph.

Signature of the candidate ....

B

THE INSTITUTION OF ENGINEERS (INDIA)

8, Gokhale Road, Calcutta 20

November 1965 Examination (Old Scheme)

EXAMINATION CENTRE CHECK

....CENTRE

Name...
(in block letters) (Surname) (Others—Please give expansion of your initials only.)

Studentship No...

Roll No..
(not to be filled by the candidate)

Section B subjects		Subjects in which it is desired to appear in November 1965*
Compulsory (1) Engineering Materials		
(2) Engineering Drawing I		
(3) Engineering Drawing II		
Optional Group No.		
Subject	Code Number†	
(a)		
(b)		
(c)		

* *Please write 'Yes' against the subjects in which you desire to appear in November 1965.*

Signature of the attestor..

Membership/Associate Membership No..

Designation..

Full address..

....

Date..1965.

A copy of the candidate's photograph should be pasted here. The attestor is requested to place his signature partly covering this photograph.

Signature of the candidate..

†For Code number please refer reverse of this Form

CODE NUMBERS FOR OPTIONAL SUBJECTS OF SECTION B (OLD SCHEME)

Group I			
	(a)	Theory and Design Structures	0111
	(b)	Geodesy	0121
		Building Construction	0122
		Geology	0123
		Soil Mechanics and Foundation Engineering	0124
	(c)	Hydraulics and Hydraulic Machinery	0131
		Machine Design	0132
		Roads	0133
		Railways	0134
		Town Planning	0135
		Harbours and Docks	0136
		Architecture	0137
Group II			
	(a)	Theory and Design of Structures	0211
	(b)	Hydraulics and Hydraulic Machinery	0221
		Geology	0222
		Soil Mechanics and Foundation Engineering	0223
	(c)	Irrigation	0231
		Water Supply and Sanitary Engineering	0232
		Hydro-Electricity	0233
		Agricultural Engineering	0234
		Machine Design	0235
Group III			
	(a)	Machine Design	0311
	(b)	Workshop Technology	0321
		Metallurgy	0322
		Metrology and Machine Tools	0323
		Electric Traction	0324
		Industrial Engineering and Management	0325
	(c)	Hydraulics and Hydraulic Machinery	0331
		Theory and Design of Structures	0332
		Electrical Machinery	0333
		Electrical Engineering General	0334
		Aeronautics	0335
		Refrigeration and Air Conditioning	0336
Group IV			
	(a)	Thermodynamics and Heat Engines	0411
	(b)	Machine Design	0421
		Workshop Technology	0422
		Engineering Chemistry	0423
		Refrigeration and Air Conditioning	0424
	(c)	Electrical Engineering General	0431
		Theory and Design of Structures	0432
		Hydraulics and Hydraulic Machinery	0433
		Metrology and Machine Tools	0434
		Aeronautics	0435
		Industrial Engineering and Management	0436
Group V			
	(a)	Electrical Engineering General	0511
	(b)	Electricity Supply	0521
		Electrical Machinery	0522
		Radio Communication	0523
		Hydro-Electricity	0524
	(c)	Hydraulics and Hydraulic Machinery	0531
		Thermodynamics and Heat Engines	0532
		Theory and Design of Structures	0533
		Line Communications	0534
		Building Construction	0535
		Electrical Measurements	0536
		Electrical Installations	0537
		Electric Traction	0538
		Ultra-High Frequency Technique including Radar and Centimetre Waves	0539
Group VI			
	(a)	Engineering Chemistry	0611
	(b)	Thermodynamics and Heat Engines	0621
		Electrical Engineering General	0622
		Machine Design	0631
		Electrical Machinery	0632
		Hydraulics and Hydraulic Machinery	0633
Group VII			
	(a)	Engineering Chemistry	0711
	(b)	Building Construction	0721
		Geology	0722
	(c)	Water Supply and Sanitary Engineering	0731
		Agricultural Engineering	0732
		Theory and Design of Structures	0733
		Hydraulics and Hydraulic Machinery	0734
Group VIII			
	(a)	Theory and Design of Structures	0811
	(b)	Stability and Resistance of Ships	0821
		Aeronautics	0822
	(c)	Thermodynamics and Heat Engines	0831
		Electrical Machinery	0832
		Machine Design	0833
Group IX			
	(a)	Principles of Mining	0911
	(b)	Geology	0921
	(c)	Machine Design	0931
		Mining Metallurgy	9932
		Thermodynamics and Heat Engines	0933
		Electrical Machinery	0934
		Geodesy	0935
Group X			
	(a)	Gas Engineering	1011
	(b)	Engineering Chemistry	1022
	(c)	Thermodynamics and Heat Engines	1031
		Machine Design	1032
		Theory and Design of Structures	1033
Group XI			
	(a)	Mechanics of Fluids	1111
		Machine Design	1112
	(b)	Transport and Storage of Materials	1121
		Instrument and Automatic Control in Chemical Industry	1122
		Size Reduction, Mixing and Separation	1123
	(c)	Principles of Heat Transmission, Heat Transfer Equipment and Refrigeration	1131
		Diffusional Processes, Evaporation and Distillation	1132
		Materials and Mechanical Construction of Chemical Plants	1133
Group XII			
	(a)	Fuels and Combustion	1211
		Power Generation and Distribution in Chemical Industry	1212
	(b)	Principles of Heat Transmission and Furnaces	1221
		Thermodynamics and Heat Engines	1222
	(c)	Size Reduction, Mixing and Separation	1231
		Chemical Works Design and Construction	1232
		Diffusional Processes, Evaporation and Distillation	1233
		Instruments and Automatic Control in Chemical Industry	1234
Group XIII			
	(a)	Electro-Chemistry	1311
		Industrial Stoichiometry	1312
	(b)	Electrical Engineering General	1321
		Instruments and Automatic Control in Chemical Industry	1322
	(b)	Diffusional Processes, Evaporation and Distillation	1331
		Principles of Heat Transmission, Heat Transfer Equipment and Refrigeration	1332
		Chemical Works Organization and Management	1333
Group XIV			
	(a)	Materials and Mechanics Construction of Chemical Plants	1411
		Principles of Heat Transmission, Heat Transfer Equipment and Refrigeration	1412
	(b)	Transport and Storage of Materials	1421
		Mechanics of Fluids	1422
		Power Generation and Distribution in Chemical Industry	1423
	(c)	Diffusional Processes, Evaporation and Distallation	1431
		Fuels and Combustion	1432
		Chemical Works Design and Construction	1433

COPY TO BE DELIVERED BY THE BANK TO DEPOSITOR AS RECEIPT

A EXAMINATION FEE

NOVEMBER 1965
EXAMINATIONS
(Old Scheme

Your examination fee for Section A/B for the above examination may be paid at any Branch in India, including the Andaman and the Nicobar Islands, of the State Bank of India, without any charge, by presenting this card with your remittance.

Received for credit of THE INSTITUTION OF ENGINEERS (INDIA), Calcutta Rs. 50 00 **(Rupees Fifty only).**

For STATE BANK OF INDIA

(Receiving Bank's Seal) AGENT

TEAR HERE

B

COPY TO BE RETAINED BY THE BANK

(FOR TRANSMISSION TO BENEFICIARY)

To
All Indian Branches of
The State Bank of India

On behalf of THE INSTITUTION OF ENGINEERS (INDIA), Calcutta, please receive from (name and number as on the reverse) the sum of **Rs. 50.00 (Rupees Fifty only).**

B. Seshadri
Secretary

Received for credit of THE INSTITUTION OF ENGINEERS (INDIA), Calcutta. Rs. 50.00 **(Rupees Fifty only).**

For STATE BANK OF INDIA

(Receiving Bank's Seal) AGENT

(To be used by the Institution office only)

The above amount received through our Bankers is adjusted as your examination fee for the examination to be held in :

NOVEMBER 1965
(Old Scheme)

for Secretary
The Institution of Engineers (India)

INFORMATION

1. The name, address and Studentship No are to be entered by the candidate on both Cards A and B below in block letters.
2. This card is to be used for remittance of Examination Fees only and **not** for Subscriptions.
3. Card A duly stamped and signed by the Bank in respect of payment by the candidate should be attached to the examination form and sent to the Headquarters Office direct, without which the examination form will not be considered.
4. Card B will be retained by the Bank on receiving payment and will thereafter be sent to the Head Office of the State Bank of India, Calcutta. The Institution, after receiving Card B from the State Bank of India, Calcutta, will return it to the candidate after verification and adjustment in due course. No other receipt will be issued.
5. Mention the code No. as given in the top of the application form in the spaces provided below.
6. All correspondence in this connection should be addressed to the Headquarters Office The Institution of Engineers (India), P. O. Box 669, Calcutta, and not to the Bank.

A

Code No.

TO BE FILLED IN BY THE CANDIDATE IN BLOCK LETTERS

NAME .... Studentship No. ....

ADDRESS ....

....

....

------------------------- TEAR HERE -------------------------

B

Code No.

TO BE FILLED IN BY THE CANDIDATE IN BLOCK LETTERS

NAME .... Studentship No. ....

ADDRESS ....

....

....

From

The Institution of Engineers (India)
8 Gokhale Road, Calcutta 20

Form 362

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

November 1965 Examination (New Scheme)

General information and instruction to candidates

(Approved by the Examinations Committee, 51st Meeting, Resolution 21, 30th December, 1958)

(Revised by the Examinations Committee, 57th Meeting, Resolution 19, 27th-29th June, 1961, and 58th Meeting, Resolution 10, 13th and 14th October, 1961).

(1) The next Associate Membership (Sections A and B) Examinations (new scheme) will be held from Monday, November 8, 1965 to Tuesday, November 23, 1965, excluding Sundays, 14 and 21, and Tuesday, November 9, 1965. The application forms for the Associate Membership (Sections A and B) Examinations (new scheme) and the programme of examinations are attached to this *Bulletin.*

(2) **All applications accompanied by examination fees for admission to the November 1965 examinations should reach the Head Office before 4.00 p.m. on Wednesday, September 15, 1965.** Examinations fees once paid are neither refundable nor transferable to a subsequent examination or to any other account. Receipt of examination forms will not be acknowledged by the Head Office, unless accompanied by a self-addressed post-card.

(3) **Examinations fees should be preferably deposited at the State Bank of India in the candidate's locality. Attention of the candidate is specially drawn to item 3 in Form 363 and item 5 in Form 364 in this regard. The instructions for making such payment are given in Card A (attached herewith) and on its reverse. Other modes of payment may be used only if this is not possible. Payment of examination fees by cheque, postal orders or money order will not be accepted.**

Mention the code number as given in the top of the application form in the bank card.

(4) No application for a change of examination centre will be entertained after 4.00 p.m. on Wednesday, September 15, 1965.

(5) Students who are in arrears of subscription will not be admitted to the examinations.

(6) **The Institution reserves the right to reject incomplete or illegible applications without any reference to the candidate.**

(7) No Student will be permitted to appear in the Section B examination unless he has fully passed the Section A examination or secured exemption therefrom. A candidate for the Section B examination should therefore mention the year in which he passed the Section A examination.

(8) Students appearing for the Section B examination under the revised rules 17(a) to 17(i) of the rules of examinations (see Rules and Syllabuses of Studentship and Associate Membership Examinations) should clearly state in the application form the name of the Local Centre to which they are attached.

(9) A candidate who has already passed the Section A and B examinations or is exempted therefrom will be permitted to appear in any paper or papers of Section A and/or Section B (new scheme) on payment of an examination fee of Rs. 50.00 per paper. The details of passing the Section A and B examinations or of exemption therefrom should be clearly stated in the examination form, with the grade of membership.

A candidate may also appear in one complete branch of engineering on payment of usual examination fee of Rs. 75.00. Rules of examination for such a candidate will be identical with those applicable to regular candidates.

(10) The Design and Drawing papers are of 5½ hours duration, with a one-half hour recess between. Candidates will not, however, be permitted to leave the examination hall.

(11) Candidates are not permitted to use handbook(s) for the paper in 'Design and Drawing' of Section B. They may, however, use steel tables of the Dorman-Long type.

General information and instruction to candidates (*contd.*)

(12) Candidates detected using unfair means in the examination hall will be expelled from the Institution and will not be re-admitted to the Institution at any future time.

(13) Candidates reappearing in subject(s) in which they have already secured exemption(s), will have their paper(s) cancelled. The previous exemption(s) will stand.

(14) It is sometimes found that candidates do not enter their Studentship Number, Roll Number, or other necessary particulars on the answer-books. Such answer-books will be rejected and no attempt will be made to locate the candidates. Candidates should therefore take particular care to write down these particulars on the answer-books correctly.

(15) The results of the November 1965 examinations (new scheme) will be declared before the last day of February 1966.

(16) Candidates will be permitted to apply for the checking of their answer-books as to whether the marks allotted in the answer-books were added correctly and all the answers within the answer-books were appropriately marked, on payment of Rs. 5 as checking fees for each paper. Candidates wishing this check to be made should apply to the Controller of Examinations within 15 days of the date of posting the results by him.

(17) **The marks of each examination will be communicated to candidates along with results free of charge.**

(18) The Institution reserves the right to cancel the results of any candidate without assigning reasons in which case, the marks will not be supplied.

(19) In any future correspondence, in regard to the November 1965 examination (new scheme), candidates should always mention the Section of the Associate Membership Examination in which they appeared and their centre of examination in November 1965.

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

November 1965 Examinations (New Scheme)

Programme

	S.T. 10.00 to 1.00	S.T. 2.00 to 5.00
	Associate Membership Examination—Section A	
Monday, November 8, 1965	Mathematics I	Mathematics II
Wednesday, November 10, 1965	Applied Mechanics	Principles and Applications of Electricity
Thursday, November 11, 1965	Heat, Light and Sound	Engineering Drawing
Friday, November 12, 1965	Strength of Materials	Elementary Surveying
	Associate Membership Examination—Section B	
Monday, November 8, 1965	Materials and Construction Mechanical Engineering Materials Electrical Engineering Materials Chemical Engineering Materials Principles and Practice of Coal Mining Mineral Dressing Electronics and Telecommunication Materials	Theory and Design of Structures Industrial Organisation and Management Theory and Performance of Electric Machines Industrial Stoichiometry and Mechanics of Fluids Principles and Practice of Metal Mining Physical Metallurgy and Physical and Mechanical Testing of Metals
Wednesday, November 10, 1965	Structural Engineering Generation, Transmission and Distribution of Electric Power Diffusional Processes, Evaporation and Distillation Mine Ventilation, Explosions, Fire and Inundation Refractories Applied Electronics and Circuits	Surveying and Geodesy Theory of Machines Electric Traction Fuels and Combustion Mine Surveying Foundry Engineering Transmission Lines and Networks
Thursday, November 11, 1965	Hydraulics Industrial Engineering Illumination Engineering Elementary Electrical Engineering Mineral Dressing Practice Metallurgical Analysis Advanced Radio and Electronic Engineering	Highway Engineering Fuels and Refractories Radar Engineering and Microwave Techniques Workshop Technology
Friday, November 12, 1965	Civil Engineering Design and Drawing Mechanical Engineering Design and Drawing Electrical Engineering Design and Drawing Chemical Engineering Design and Drawing Electronics and Telecommunication Design and Drawing	(From 10 a.m. to 1 p.m. and 1.30 p.m. to 4 p.m.)
	Mining Machinery Physics of Metals	Generation, Distribution and Utilisation of Power in Mines Metallurgy of Less Common Metals

Programme—(*Contd.*)

Saturday, November 13, 1965	Geology Production Technology Non-ferrous Metallurgy	Thermodynamics and Heat Engines Size Reduction, Mixing and Separation Telegraphy and Telephony
Monday, November 15, 1965	Railways General Mechanical Engineering	Hydraulics and Hydraulic Machinery
Tuesday, November 16, 1965	Irrigation Engineering Refrigeration Line Communication Gas Engineering Mining Geology Industrial Metallurgy Antenna and Wave Propagation	Harbours and Dock Drilling Engineering Television Utilisation of Electric Power Principles of Heat Transmission and Furnaces
Wednesday, November 17, 1965	Metallurgy of Iron and Steel Industrial Administration	Water Power Engineering Electrical Measurements Heat Treatment of Metals and Alloys
Thursday, November 18, 1965	Public Health Engineering Railway Locomotives and Rolling Stock General Electronics Refrigeration and Air-Conditioning Mine Economics Electrometallurgy and Hydrometallurgy Electronic Measurements	Thermal Power Engineering Servomechanisms
Friday, November 19, 1965	Town Planning Automobile Engineering High Frequency Currents Chemical Works Organisation and Management Metallurgy and Assaying Fuels and Furnaces Industrial Electronics	General Electrical Engineering
Saturday, November 20, 1965	Architecture Air-Conditioning Radio Communication Materials and Mechanical Construction of Chemical Plants Mine Design and Planning Metallurgical Thermodynamics Radio Communication Systems	Soil Mechanics and Foundation Engineering Aerodynamics Hydro Power Engineering Metallurgy Mine Organisation and Management Engineering Metallurgy Audio Frequency Engineering
Monday, November 22, 1965	Production Technology and Industrial Engineering Principles of Semiconductors and Transistor Circuits	Agricultural Engineering Thermodynamics Carrier Current Engineering
Tuesday, November 23, 1965	Principles of Line and Radio Communication	

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THE BULLETIN
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HYDRAULIC SPECIALIST

Wanted a Hydraulic Specialist Consultant by a leading Diecasting Foundry for advice on the planning of a central hydraulic power unit to work at about 150 atmospheres. The consultant should be able to make layout. Post for an entirely automatic set-up.

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SOLAR ENERGY AND ITS UTILIZATION

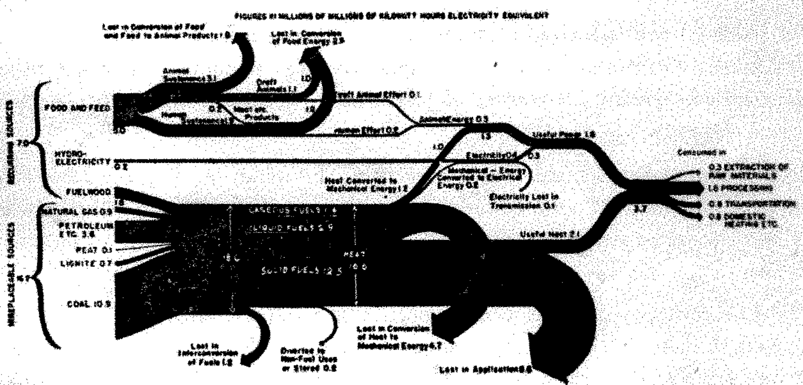
M. K. Ghosh
Non-member

General

We know that the sun is a source of energy. As a matter of fact, whatever energy we use on the surface of the earth is derived from the sun directly or indirectly.

The sun is continually radiating energy from its surface at a temperature of about 6,000°K., the total quantity being 4.05×10^{27} kW, of which only 1 part in 2,000 millions falls just outside the atmosphere of the earth ; *i.e.*, 1.94 cal. per min. per cm.^{2} is the average for the whole year. Some of it is absorbed, scattered and reflected by the atmosphere. As a result, we receive 1.42 cal. of energy per min. per cm.^{2} on the surface of the earth. Though this seems to be very small, the total amount of solar energy we receive is 2.01×10^{18} kW.

According to a statement made by the U.S. State Department in 1937, mankind consumes 16×10^{12} kW of energy from irriplaceable sources, *viz.*, coal, petrol, etc. and 5×10^{12} kW in the form of food for man and domestic animals, the total being 21×10^{12} kW. In other words, man derives substinence for himself and the domestic animals entirely from the current supply of solar energy, and about 90% of the energy for the present type of civilization from solar energy stores such as coal and petrol. The whole energy consumption position has been depicted in a graph (*vide* Fig. 1).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Lost in Conversion of Food and Feed to Animal Products
Lost in Conversion of Food Energy
Animal Sustenance 3.1
Draft Animals 1.1
1.0
Draft Animal Effort 0.1
FOOD AND FEED
Human Sustenance
Meat etc. Products
5.0
Human Effort 0.2
Animal Energy 0.3
Useful Power 1.6
1.0
7.0
HYDRO-ELECTRICITY 0.2
Electricity 0.4
0.3
Heat Converted to Mechanical Energy
Mechanical — Energy Converted to Electrical Energy 0.2
Electricity Lost in Transmission 0.1
FUELWOOD
1.8
NATURAL GAS 0.9
PETROLEUM ETC. 3.6
PEAT 0.3
LIGNITE 0.7
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GASEOUS FUELS
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Consumed in
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1.0 PROCESSING
0.8 TRANSPORTATION
0.8 DOMESTIC HEATING ETC.
Lost in Interconversion of Fuels 1.8
Diverted to Non-Fuel Uses or Stored 0.8
Lost in Conversion of Heat to Mechanical Energy 4.7
Lost in Application
RECURRING SOURCES
IRREPLACEABLE SOURCES

Fig. 1

Origin and Utilization of Energy in the World in 1937
(from "Energy Resources of the World")

The position of the irreplaceable fossil fuel in the world is not very hopeful. Soon we shall feel the shortage of it. It is said that if the consumption goes on at the rate of 1937, it may last for another 2000 years. But along with the industrialization of the whole world, the demand for fuel is also increasing very rapidly. It is said that if the consumption of the whole world is at the rate of the highest consumption in some parts of the U.S.A., it will probably last only for 20 years. This may require corrections after the survey of the oceans being done as a programme of the Geophysical years is completed. It is expected that more fossil fuel will be discovered under the beds of oceans.

In future, the probable sources of energy may be described as (a) atomic energy, (b) energy from tides and wind, (c) energy available due to the difference of temperatures on the surface of the sea and at some depth, and (d) solar energy.

The main difficulty in utilizing solar energy is its low quantity per unit area. From 1 gm. of coal, we get an energy of 6,000 cal., say. To get the same quantity of energy from the sun, we require more than 4,300 cm.^{2} of surface. The other difficulty is that its supply is not continuous but intermittent. In spite of the difficulties, attempts are being made to use solar energy effectively.

Utilization of solar energy

The fields of use of solar energy may be grouped as below :

(i) Fields where the temperature and the quantity of energy required are high ;

(ii) Fields where the temperature required is high but the quantity is not high ;

(iii) Fields where the temperature is low and the quantity is high ; and

(iv) Fields where both the temperature and the quantity are low.

For fields (i) and (ii), concentration of solar energy from a big surface to a point or from a small area through lenses or reflectors becomes inevitable; and for fields (iii) and (iv), the methods require conversion of solar energy into heat, electricity, chemical or mechanical energy.

Prof. Conn of the United States and Prof. Trombay of France, have through parabolic reflectors, raised temperatures up to about 3,600°C. This temperature has yet not been raised by any other method. This device is best suited for experiments on refractories.

The U.S.S.R. has installed various apparatus to utilize solar energy. The most encouraging of them is a boiler in Tashkant. This is a device for concentrating solar energy into a boiler through a series of plane glass mirrors, 45 in number, in three series, mounted on concentric rail lines. The total area of the reflectors is 20,000 m.^{2} This is capable of producing 9.6 kilo cal. of heat per hr. and 13 tons of steam per hr.

House heating is expensive in some parts of the U.S.A. In Miami, Florida, 15,000 houses have solar heating systems. They utilise the heat of fusion of Glauber salt. During the day, Glauber salt is melted by the sun and during solidification in the night, the salt releases its latent heat of fusion. This heat warms up the house. It is estimated that by 1975, the potential market for house heating would be 15 million houses. The cost of a heating unit is estimated to be $ 2,000 to 3,000 per house.

Solar engines were devised by Pifre as early as 1882 and by others later. When solar engines become available for commercial use, solar energy can be utilized for pumping water, running machines, etc. The Eneas engine (1901) pumped out 100,000 gallons of water in one hour.

Various methods for converting solar energy to electricity or chemical energy have been experimented on a laboratory scale. The most efficient of these devices is the silicon cell. Its efficiency is about 10%. The cell was invented by chance by the Bell Telephone Co. Current is produced when sun rays fall on this cell. Silicon cell combinations are used for telephones, charging batteries, radio receivers and other uses. Energy is supplied by these cells to run fine instruments in artificial satellites and spaceships. There is no other known form of energy available for these ships.

An attempt for using solar energy is being made by increasing the efficiency of fixing carbon in plants. In nature, it is not effective by more than one percent. A group of workers are experimenting on plant life, particularly on algae, which can be used both as fuel and food.

Solar cookers have been tried by various workers. Both concentration and conversion of solar energy have been used for making sun-cookers; some names that require special mention in this field of work are Sansura (1940-90), Herchel (1834-38), Lency and Abbot. In India, the first design was made by Adams (1878), followed by Joshi (1900) and the author of this paper in 1934 (Fig. 2). The designs have improved since 1945. The National Physical Laboratory brought out a sun-cooker in 1950-52. Excepting the cooker designed by the author, the others were based on concentration of solar energy through reflectors. The authors device works on the transformation of solar energy to heat based on the principles of a black body (Fig. 3). The design consists of two double walled boxes A and B made of teak wood with air space between. The walls of the inner box are inclined at 45° to avoid the shadow of the walls falling inside the working box. The inner box A is on springs C and contains the cooking utensils with the food materials. The same cover keeps both the boxes airtight. The cover DFEF forms a chamber. On two faces of a black painted wooden frame, two plain window glasses D and E are fixed. The area of the outer glass is double the inner glass D. Half of the light that passes through the outer glass falls on the black painted surface of the wooden frame and the other half passes into the inner box A through the inner glass D. The rays that fall on the wooden frame F are transformed into heat and raise the temperature of the air in the chamber DFEF. Thus, the difference of temperature on the sides of the inner glass D is reduced. This stops conduction through glass to a great extent. Thus, it is possible to compensate for the deficiency of the low non-conductivity of glass.

For the protection of the glass panes when not in use, a wooden cover G is used and a mirror lining is given on the inner face of the cover. While in use, the cover can be adjusted to any angle. Some additional radiation, reflected from the mirror, enters the box. When the sun is inclined, the radiation is large. This compensates to some extent the reducing effect of the inclined sun.

The temperature of the inner box is recorded to be as high as 160°C. varying from 140° to 160°C. according to the position of the sun and the condition of the sky.

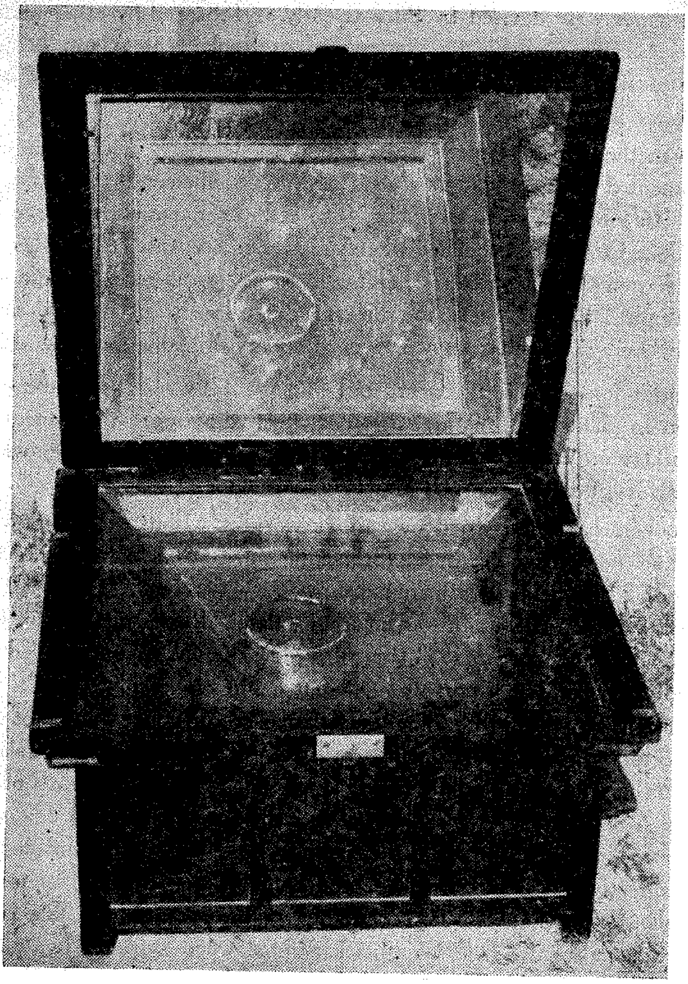

Fig. 2

A solar cooker (author's design)

This design has been found to attain the highest temperature, and its advantages are:

1. Operation is easy;
2. Cooking of all dishes (in the available space) is done simultaneously in less than two hours;
3. It can cook both lunch and dinner within the period of sun-shine;
4. There is no necessity to turn the box frequently along with the sun, as in designs based on the reflector principle;
5. It can fry certain materials ;
6. There is no need for attention during cooking; and
7. It can preserve heat to some extent.

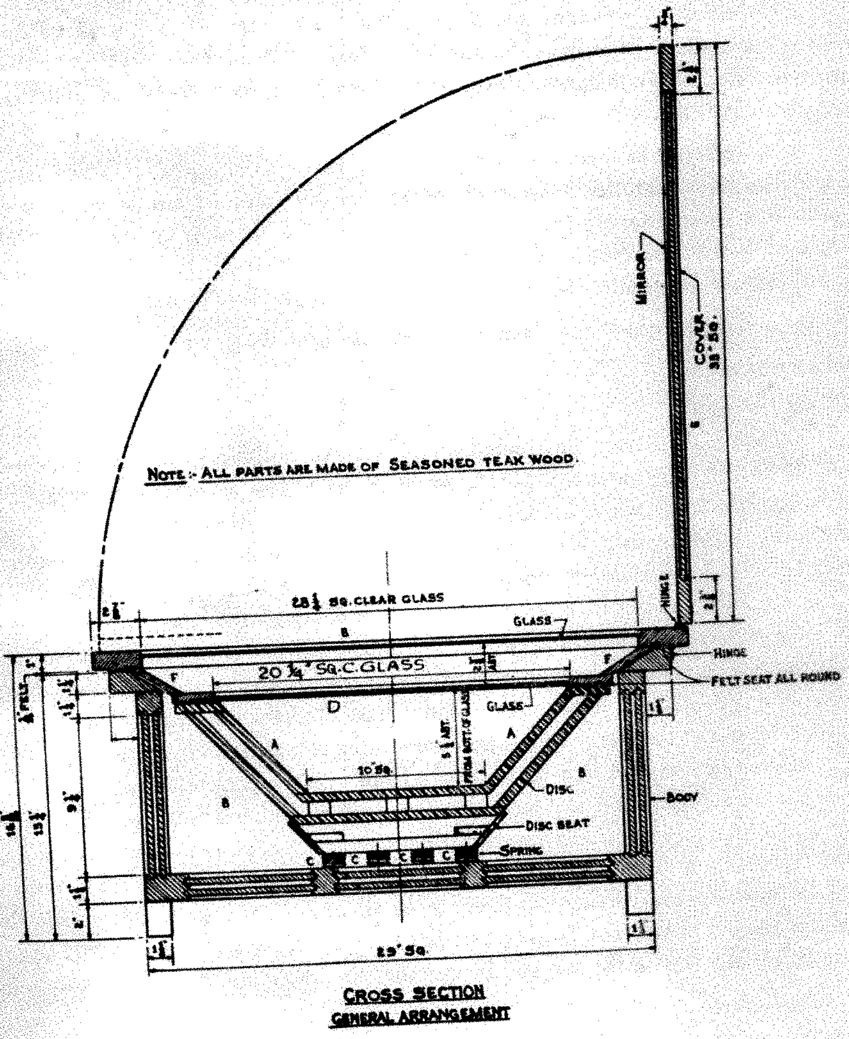

Fig. 3
Sun cooker box details

The food is found to remain warm even at the time of dinner. The only disadvantage is its high cost. The cost of an experimental unit is more than Rs. 250.00, which is rather high. Recently, another design has been successfully tried and its cost is below Rs. 100.00. It may be reduced even to Rs. 50.00 if manufactured on a mass scale. This design is similar to the above. Only a mud wall enclosure replaces the double box. The mud wall is about 7.5 cm.^{2} thick at the top and inclined at 45° on the inner side. An iron trough of the same shape is placed within the mud wall and a lining of slag-wool (about ½ in. thick) is introduced between the mud walls and the iron trough. The cover of the cooker is similar to that of the former design, with the only difference that the cover is hinged to another wooden fame thrust into the top of the mud walls.

The highest temperature recorded in this design was 140°C. Cooking also has been successfully tried in this design. The advantage of this device is that the villagers can make the cooker themselves provided the cover frames, iron trough and slag wool are available to them.

A water heater has also been designed to work on solar energy. The cooker box system has been adopted, in which a copper pipe with an inlet and an outlet is coiled. Cold water enters through the inlet and comes out hot through the outlet. A unit of two such heaters can heat about 10 gallons of water from 25° to 55°C. in about 4 hr. Steam can also be produced in this unit by regulating the flow of water.

A combined cooker-water heater unit has also been designed.

Industrial uses

Making palm gur

A paraboloid reflector constructed at the Tata Iron and Steel Co., Ltd., Jamshedpur, dried 19 lb. of palm juice to 4 lb. of gur in 2½ hr. The reflector concentrated solar energy near the focus, where a piece of wood came to flame within a few seconds. Though successful experimentally, it was costly and its manufacture on a commercial scale was not considered feasible due to many reasons. Recently another apparatus (Fig. 4) which has been found to be better suited for manufacture of gur by the villagers has been designed. An inclined wooden frame of size 190 cm. × 127 cm. is covered with corrugated iron sheet, the corrugation being horizontal across the length. About 2 cm. thick packing of slag wool is introduced between the wooden frame and the iron sheet. There is a platform on the top of the frame with a perforated tube along the width of the frame. On the platform, juice is kept in a vessel, which flows into the perforated tube, from which it cripples on the iron sheet and flows downwards in a number of streams. The flowing juice is caught in an iron channel, which drains back into a vessel. This juice is transferred repeatedly into the container at the top platform. By repeating the process for about an hour, the evaporation was noted to be about 70% of juice (3,200 litres). The juice was thick and was not flowing through the perforations of the tube. The juice was then left in a tray in the sun and by evening, the whole liquid was in a pasty form.

Salt manufacture

Solar energy is used for drying sea water and manufacturing salt. The efficiency of the drying is increased by 20% by the addition of a dye in sea water and by about 40% in the case of dead sea water. A manufacturing company has been on work in this field.

Use in our country

Solar cookers and solar water and house heaters would be most suitable for our defence personnel in Ladak and NEFA. Wood and fossil fuels are not available there but solar energy is abundant. Trucks may be possibly converted into mobile cookers and water heaters based on the designs described here. It is not known whether the Defence Department has done anything in this matter.

The main difficulty in this field of work in India is that no institution or organization has taken interest. Even countries like the U.K., the U.S.S.R., and the U.S.A., where solar energy is not plenty enough to think of its use, are engaged in carrying out

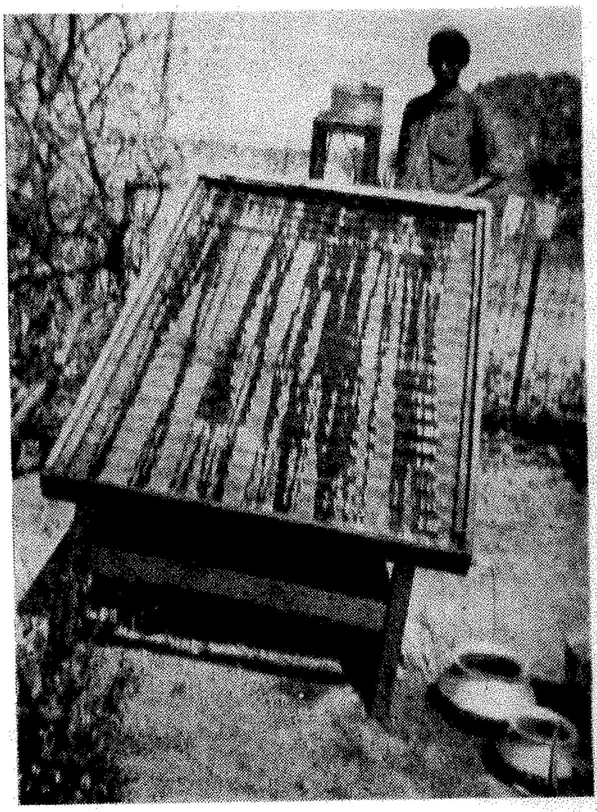

Fig. 4

Another design of solar cooker

research work on this subject. In India, some individuals are working on it as a hobby. It would be a matter of pleasure if the Institution looks to this problem with interest.

It is hoped that with whatever has already been achieved particularly in the matter of cooking by solar energy, help may be extended to the villagers to solve their fuel problems to some extent. In rainy season, of course, solar cookers, at this stage, cannot be used ; however at least 8 months in the year, we can save fuel for cooking.

Acknowledgments

It was the late Dr. Rajendra Prasad who encouraged the author to pursue this hobby, which he again followed with vigour since 1945. The author owes his gratitude to Sir Jehangir Ghandy also for the help extended to him. His thanks are due particularly to Shri Krishna Das Ghandi and Prof. Humayun Kabir for the grants made available to him from the Sarba Seva Sangh and the Ministry of Scientific Research and Cultural Affairs, and to friends who encouraged him with advice and discussions. He also thanks Shri Ram Bilas Sarma who constructed the apparatus according to the author's designs.

Summaries of Papers Published in Journal, vol. 45, no. 12, pts. EL 6 & HI 3, August 1965

ELECTRICAL ENGINEERING DIVISION

Transient Current in Three-Phase Induction Motor on Reconnection with Supply Line

Amarjit Singh

Non-member

In an induction motor, transient current flows during switching operations. The magnitude of the transient current may be several times the steady state current. In this paper, an attempt is made to analyze the transient current flow, when a three-phase induction motor is reconnected with the supply line, using the method of symmetrical components. The calculated values are verified by experiments on a four-speed pole-changing induction motor and a satisfactory agreement of the results is obtained.

Some Notes on High Voltage Air Blast Circuit-Breakers

B. N. Biswas

Non-member

In this paper, the working conditions of a circuit-breaker in an extra high voltage high capacity transmission system are described and it is shown that the air blast circuit-breakers are the most economical for high voltage operation. The constructional features of a typical air blast circuit-breaker are described and the need of a reliable compressed air system for the efficient performance of the breaker is stressed. A reference is also made to the special insulation requirements and the high speed auto-reclose feature on such circuit-breakers.

Some Design Considerations of 1180 MW Nuclear Power Station at Wylfa

S. K. Biswas

Associate Member

Great Britain has played a vital role in fostering the peaceful uses of atomic energy. In the field of generation of electricity from nuclear power, her pioneering ventures in the earlier years culminated in the design of the world's most powerful nuclear power station. In this paper, the design considerations of the 1180 MW Wylfa power station are described.

Torque in an Electrical Machine—How It is Produced

Dr. A. K. Das Gupta

Member

In this paper, it is shown that the common theory of the formation of torque in an electrical machine based on the distortion of the magnetic flux or the repulsion of the similarly oriented lines of forces, or the magnetization due to the flow of rotor current, is not correct. By theoretical analysis, the lacuna in the existing theories are brought out and a possible reason for torque formation in an electrical machine is suggested.

Reliability of Switched Standby Communication Power Plants

K. S. Prabhu

Non-member

Transfer of a communication system load from the normal to the standby power source is done in emergency by a switch, after the failure of the normal supply source is detected by a sensing device. In this paper, an expression for the overall reliability of a power plant using a switch to transfer the load from one source to another is derived based on the elementary reliability theory. The reliability of a switch in either of the two rest positions is taken to be different from the reliability with which it shifts from one position to another.

High Rupturing Capacity Fuses

M. R. Raja

Non-member

An increase in the capacity of a power supply system raises the fault level at the consumers' terminals. For the protection of the supply system, high rupturing capacity fuses are often used. In this paper, the inherent characteristics of the modern high rupturing capacity fuses are described and a brief analysis of the nature of protection afforded by such fuses is given.

Economics of Diesel Electric Generation

K. R. Ramachandran

Associate Member

Although the super-power stations and extra high voltage power grids have come to stay, the Diesel power station has not lost its usefulness. Installed in an industry, a Diesel power plant can take the load off a large grid system during its peak load periods ; also, it can continuously share the load with the grid supply in an overloaded system or act as a standby for supply in case of failure of the grid. In this paper, the economic potential of Diesel electric generation is analyzed and it is stressed that small and medium capacity Diesel electric stations are of considerable usefulness in a growing economy, if used along with large hydro and thermal power stations.

Self-Regulation of Alternators—a New Device

S. C. Rao

Non-member

This paper describes a static voltage regulator, comprising a transformer and four silicon rectifiers connected as a bridge network, for use with low power single-phase alternators and compares its performance with that of the commutator-brush system of voltage regulation. The paper also indicates that due to its economic and robust construction, such units are particularly suitable for use in military and marine installations.

Problems of Rural Electrification with Special Reference to Bihar State

A. S. Srivastava
Member
and
N. Prasad
Non-member

In this paper, the socio-economic and technical problems involved in the electrification of rural areas are analyzed with particular reference to the Bihar State. The need for drawing up a master plan for electrifying the entire rural area of the State is stressed. It is pointed out that although the execution of the plans may keep pace with the availability of the resources, a master plan will enable proper design of the grid system, *e.g.*, the location and design of grid substations at 'focal' points so as to cater for the rural electrification feeders in future. Also, the need for an integrated organization for rural electrification is stressed and a suitable modification in the electricity tariff for rural areas is proposed.

Study of the Harmonics in the Charging Current and Receiving End Voltage of an Open Circuited 66 kV Line

N. Krishna Murthy
Non-member
and
D. J. Badkas
Associate Member

A model of a 66 kV three-phase circuit line has been constructed to study the harmonic contents in the charging currents. The experiment has been carried out by energising the line by a sine wave generator and through transformers of various types of connections. The results are tabulated and the oscillograms are given. The third harmonic is found to be predominant in all the cases.

HINDI SECTION

Sharavati—the Hydel Project of the East

L. T. Aminbhavi
Non-member

The power potential of the Sharavati River in Mysore was not fully known when, in 1948, the Mahatma Gandhi Hydro-Electric Work, with an installed capacity of 120,000 kW and built at a cost of Rs. 6 crores, was switched on. Investigations were started in 1952 to utilize the full power potential of the river. As a result, the present Sharavati hydel project was conceived. It will have a total installed capacity of 891,000 kW and cost Rs. 124 crores. The first generating unit was switched on in January 2, 1965, by our Prime Minister. Construction of the project started in 1958, and it is likely to be completed in 1968. The paper describes the main features and the organizational set-up of the project.

Problem of Temperature in Metal Cutting

C. B. Mishra

Graduate

In this paper, the problem of temperature rise during metal cutting operation is analyzed with special reference to orthogonal cutting with type-2 chip formation. Firstly, the main sources of heat generation during metal cutting operations are explained and the average temperature of a chip as it leaves the shear zone is determined. From the experimental results, expressions for the shear plane temperature and the tool-face temperature rise are derived. Based on the analysis, it is concluded that temperature rise in a cutting operation depends on shear stress, cutting speed, depth of cut, shear strain, and coefficient of friction.

Construction Projects of the Railways and the Engineer

B. C. A. Padmanabhan

Non-member

The paper describes the conditions under which a civil engineer has to survey and prepare project reports for the laying of railway lines. He has to work day or night for their execution without caring for the vagaries of climate and difficult terrains. Simultaneously, he has to look after the welfare of the fellow-workers, whose goodwill and cooperation are essential for the successful completion of the project.

Development Projects and Wild Life Conservation

B. Seshadri

Member

An unprecedented human population explosion is depriving the wild life of the world of its habitats. In India, development projects such as for power, irrigation, industrial expansion, settlement and agriculture are the greatest destroyers of nature. Wild life is an abiding beauty of nature and a thing of matchless beauty. Its continued existence in India has reached a precarious stage. Planning of development projects does not at all take into account the conservation of wild life and its habitats. They are implemented leaving a terrible wake of destruction of forest and vegetation blocks. Planning to include protection of these blocks will be a conservation programme, and it will consequently be unpopular. It will therefore need courage to propose and to execute. Water developments in India are the prime consumers of such areas and the major cause of extinction of wild life. Decision should not always be made on the technical front, as now, but upon a broader consideration of public interest. Engineers have a prime part to play to assure that this is done. An example is given of what has been achieved in the way of nature and wild life conservation in the Columbia River basin scheme, a giant multipurpose project in the United States. Wild life and wild life habitats are of national and sometimes international significance and should be perpetuated for future generations.

INSTITUTION NOTICES

An appeal to Corporate Members attached to the Electrical Engineering Division

The Electrical Engineering Division has attached to it over 2,500 Corporate Members. I have recently had the honour of being elected to the Chair of this Division, and look forward to guiding its activities for the next two years.

The primary purpose for which these Divisions are constituted is for the furtherance of technical activities in the respective fields of engineering. The Electrical Engineering Division is one of the older Divisions within the Institution, but even so its technical activities, reflected in the papers received for publication in the *Journal* and in the written Discussions on papers already published, are still small in number compared to what the members attached to this Division are, I am sure, capable of producing.

Since the 45th Annual Convention of the Institution, three *Journal* Parts pertaining to this Division have been published in February, April and June 1965, containing ten papers in all, with five Discussions on papers. Here again, out of these ten papers, six are by non-members. Division members will readily agree that this is not very satisfactory.

Again, out of the ten papers which are scheduled for publication in the *Journal* Part for August 1965, five are written by non-members. While I certainly welcome contributions from non-members which add to our knowledge in our field, it behoves on members to take greater part in the activities of the Division by writing more papers and more Discussions on published papers. Many of them are engaged in research or design or construction, and should have consequently much to say in the appropriate subjects from results obtained through research or experience gathered in the field.

I would like the *Journal* Part pertaining to the Electrical Engineering Division to have substantial content of high standard. Consequently, I would like to accept for publication, in consultation with members of my Board and other friends who are assisting me in this work, papers which contain original work or new field experience. I would therefore like to make a personal appeal to members in this Division to come forward and offer more papers for publication and also to send written Discussion on published papers which is an invaluable part of technical activities.

Calcutta,
15th August, 1965.

(Sd.) **H. C. Guha**
Chairman
Electrical Engineering Division

Prizes and other awards

The details of the various prizes and awards available for papers published in the *Journal*, which the Council considers sufficiently meritorious, are given below for information of members.

1. The President of India's Prize

This prize was instituted in 1921 as the Viceroy's Prize, and is of historical significance. In declaring the Institution inaugurated on the 23rd February of that year, the Viceroy, Lord Chelmsford, announced an annual prize of Rs. 500, to be called 'The

Viceroy's Prize', for the best paper presented by a member. The name was changed to 'The Governor-General's Prize' in 1947, and again in 1952 to 'The President of India's Prize', reflecting the changes in the political status of the country. It is awarded by the Government of India, on the recommendation of the Council, for the best paper published in the *Journal*. The value of the prize remains at Rs. 500.

2. The Railway Board's First and Second Prizes

These were instituted in 1931. The prizes are awarded by the Railway Board, Ministry of Railways, Government of India, on the recommendation of the Council, for the two best papers published in the *Journal* on Railway Engineering or subjects allied to it. The First Prize consists of a Gold Medal and a Cash Award of Rs. 250, and the Second Prize is a Cash Award of Rs. 250.

3. Two Institution Prizes

These were instituted in 1953. They are awarded by the Council for deserving papers published in the *Journal*. The value of each prize is Rs. 150.

4. The Union Ministry of Irrigation and Power Gold Medals and Cash Awards

These were instituted in 1958. The prizes are awarded by the Union Ministry of Irrigation and Power, Government of India, on the recommendation of the Council, for papers published in the *Journal*. One is for the best paper on the Civil Engineering Aspects of River Valley Development and the other is for the best paper on the Power Engineering Aspects of Development and Utilization. Each prize consists of a Gold Medal of the value of Rs. 150 and a Cash Award of Rs. 250.

5. The President of India's Prize (Hindi)

This was instituted in 1959. Aimed to encourage the writing of technical papers in Hindi, it is awarded by the Government of India, on the recommendation of the Council, for the best paper published in the Hindi Section of the *Journal*. The value of the prize is Rs. 500.

6. The Corps of Engineers Prize

This prize was instituted in 1962, and is awarded by the Council of the Institution of Military Engineers, on the recommendation of the Council, for the best paper published in the *Journal* on a subject of common interest to all branches of engineering. The value of the prize is Rs. 500.

7. The E. P. Nicolaides Prize

This prize was instituted in 1963 by Gammon (India), Ltd. to commemorate E. P. Nicolaides for his pioneering work in the field of prestressed concrete in India. It is awarded on the recommendation of the Council and a nominee of the firm for the best paper published in the *Journal* on Reinforced and Prestressed Concrete. The value of the prize is Rs. 450.

8. The John C. Gammon Prize

This prize was instituted in 1963 by Gammon (India), Ltd. to honour John C. Gammon for his pioneering work in the field of shell structures in India. It is awarded on the recommendation of the Council and a nominee of the firm for the best paper published in the *Journal* on Concrete Shell Structures. The value of the prize is Rs. 450.

The following Prizes to commemorate distinguished persons associated with the Institution or Indian engineering in general were instituted by the Council in May 1965. These prizes consist of a gold medal of the value of Rs. 250.00 and are given away annually for the best papers published in each of the seven Division Parts of the *Journal* and in the *Journal* of General Engineering.

9. **Sir Arthur Cotton Memorial Gold Medal** (for the best paper published in the Civil Engineering Division)

Sir Arthur Cotton has been called the father of irrigation in southern India. He converted famine-stricken tracts into rich crop producing areas by the Godavari, Krishna and Kaveri River irrigation projects. His biography, first published in 1900, was reprinted by the Institution in 1964.

10. **Sir Ganga Ram Memorial Gold Medal** (for the best paper published in the Chemical Engineering Division)

Sir Ganga Ram was a pioneer in the application of engineering to farming and successfully transformed large tracts of barren lands into fertile lands by lift irrigation. He was a Member of the Royal Commission on Agriculture in India in 1925-27. He was noted for the large sums which he gave away from his private fortune to charity.

11. **Pandit Madan Mohan Malaviya Memorial Gold Medal** (for the best paper published in the Electrical Engineering Division)

Pandit Madan Mohan Malaviya, one of the great leaders of the freedom movement, founded the Banaras Hindu University in 1915, a landmark in the history of education in India.

12. **Sir Thomas Ward Memorial Gold Medal** (for the best paper published in the Electronics and Telecommunication Engineering Division)

Sir Thomas Ward was the first President of the Institution in 1920. He was Chairman of the Organizing Committee for the proposed 'Indian Society of Engineers' which was set up on 3rd January, 1919, from which the Institution derived its foundation.

13. **Shri Jawaharlal Nehru Memorial Gold Medal** (for the best paper published in the General Engineering *Journal*)

Shri Jawaharlal Nehru, the first Prime Minister of India, was an Honorary Member of the Institution from 1948 to 1964. He inaugurated the 40th Annual General Meeting of the Institution in New Delhi on 5th February, 1960.

14. **Sir Rajendra Nath Mookerjee Memorial Gold Medal** (for the best paper published in the Mechanical Engineering Division)

Sir Rajendra Nath Mookerjee was the second President of the Institution in 1920-21, and was President when the Institution was formally inaugurated on 23rd February, 1921, by His Excellency Lord Chelmsford, Viceroy of India.

15. Dr. Rajendra Prasad Memorial Gold Medal (for the best paper published in the Mining and Metallurgy Division)

Dr. Rajendra Prasad, the first President of the Republic of India, was an Honorary Member of the Institution in 1950-62. He did signal honour to the Institution by declaring open the building of the Central India (now Delhi) Centre on 28th November, 1953.

16. Nawab Zain Yar Jung Bahadur Memorial Gold Medal (for the best paper published in the Public Health Engineering Division)

Nawab Zain Yar Jung Bahadur, President of the Institution, in 1945-46, was distinguished as an engineer, architect, administrator and diplomat. He was twice Minister in H.E.H. the Nizam's Government and also the Nizam's Agent-General in New Delhi for some time, when he conducted political negotiations of great delicacy with extraordinary understanding.

Draft Indian Standards

The following draft Standards have been issued recently.

1. Draft Indian Standard Code of Practice for Phosphate Treatment of Iron and Steel for Protection Against Corrosion—Doc : SMDC 1(419).

This code covers the processing of iron and steel to produce coatings consisting essentially of metal phosphates that are intended to be used in conjunction with organic coatings for protection against corrosion. The code also covers methods of testing finished coatings.

Members may send their comments on the above draft standard before September 8, 1965, to Dr. D. R. Malhotra, (*M.*), Golf Course Road, Ajmer, who is the Institution representative on the Sectional Committee dealing with this Standard.

2. Draft Indian Code of Practice for Construction of Timber Floors—Doc : BDC 13(839) P_2.

This code covers the fabrication and laying of timber floors and their relevant components.

Members may send their comments on the above draft code before September 11, 1965, to Shri J. Datt (*M.*), Regional Engineer, Concrete Association of India, 9 Brabourne Road, Calcutta 1, who is the Institution representative on the Sectional Committee dealing with this Code, and a copy to Shri K. K. Nambiar (*M.*), Chairman, Civil Engineering Division, Chief Engineer, Concrete Association of India, 121 Queens Road, Bombay 1.

3. Draft Amendment No. 1 to I.S. : 2115-1962 Code of Practice for Flat Roof Finish.

Members may send their comments on the above amendment before September 24, 1965, to Shri D. S. Desai (*M.*), 65 Jatindass Road, Calcutta 29, who is the Institution representative on the Sectional Committee dealing with this Standard, and a copy to Shri K. K. Nambiar (*M.*), Chairman, Civil Engineering Division, Chief Engineer, Concrete Association of India, 121 Queens Road, Bombay 1.

4. Draft Indian Standard Specification for Brush: (i) Lettering and (ii) Writing (Revision of I.S.: 1104-1957).

This standard prescribes the requirements and the methods of sampling and test for brush, lettering filled with bristles and brush, writing filled with heir and set in a suitable cement.

5. Draft Indian Standard Specification for Aquous Caseinous Pigments and Finishes—Doc: (DC 16 (2500).

This standard prescribes the requirements for casein based pigments and casein based binders, in paste to liquid form.

Members may send their comments on the above draft Standards before October 1, 1965, to Dr. V. M. Dokras (*M.*), Director of Technical Education, Government of Madhya Pradesh, Bhopal, who is the Institution representative on the Sectional Committees dealing with these Standards.

Copies of the draft Indian Standards may be obtained from the office of the Indian Standard Institution, 9 Bahadur Shah Zafar Marg, New Delhi; or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay 1; 11 Sooterkin Street, 3rd Floor, Calcutta 13; 2/12 First Line Beach Madras; or 14/69 Civil Lines, Kanpur.

Additional list of Referees for Students appearing in Section B of the Associate Membership Examination

(*continued from Bulletin for March 1965*)

The following is an additional list of Referees to that which appeared in the *Bulletin* for March 1965.

Andhra Pradesh

125.	AM	10225	M. J. S. Ahmed (E) Principal, Government Polytechnic, Mahaboobnagar.
126.	M	3001	Lt. Col. R. S. Attre (M) EME School (South), Trimulgherry, Secunderabad.
127.	AM	11648	M. A. Baksh (M) Engineer, Oil Technological Research Institute Anantapur.
128.	AM	3838	Brig. G. R. Chainani (M) Commander, Headquarters Technical Services Group, P.O. Trimulgherry, Secunderabad 15.
129.	AM	7902	K. S. J. Chakravarthy (M) Executive Engineer, P.W.D., New M.P. Division, Srikakulam.
130.	AM	4306	Brig. S. N. Docca (E) Commandant, EME School, Trimulgherry, Secunderabad 15.

131. AM 5495 P. Govindakrishnayya (M)
2/2/12/6, Amberpet Road, Jamai Osmania, Hyderabad 7.

132. AM 12532 C. B. Gupta (E)
Principal, Government Polytechnic, Stonehouse Pet, Nellore

133. AM 7089 M. A. Hussain (C)
Executive Engineer, Zilla Parishad, Srikakulam.

134. AM 11109 Y. P. Kaushal (E)
Works Manager, Ferro Alloys Corporation Ltd., Shreeramanagar, District, Srikakulam.

135. AM 5885 J. C. Maitra, (ET)
Principal Scientific Officer, Defence Electronics Research Laboratory, Chandrayana Gutta Lines, Hyderabad.

136. AM 6778 S. B. Mohiuddin (C)
Executive Engineer, P.W.D., R & B Division, Khammam.

137. AM 6256 Lt. Col. Nirula (E)
Officer Commanding, Reader Engineering Wing, EME School (South), Trimulgherry, Secunderabad.

138. AM 12534 P. Prasada Rao (M)
Assistant Director of Industries & Commerce, Nellore.

139. AM 8578 T. V. Raghava Reddy (C)
Executive Engineer, P.W.D., Construction Division No. 1, Pochampad Project, District Nizamabad.

140. AM 9694 B. V. R. Reddy (C)
Executive Engineer, P.W.D., Kurnool Division, Nandyal, Kurnool.

141. M 2874 Y. Sanyasi Rao (E)
Project Superintending Engineer, A.P.S.E.B., Somasekharapuram, Nellore.

142. AM 2596 Prof. N. Sidheswar (M)
Professor of Mechanical Engineering, Regional Engineering College, Warangal.

143. AM 11483 K. V. Subba Rao (C)
Head of Civil Engineering Section, Government Polytechnic, Guntur

144. AM 11899 R. Swaminathan (C)
Head of Civil Section, Government Polytechnic, Mahaboobnagar.

145. AM 10867 P. Veeraraju (E)
Principal, Government Polytechnic, Srikakulam.

Bihar

43. AM 11719 Shri M. S. Ramamoorthy, (E)
Lecturer in Electrical Engineering, Indian Railway School of Mechanical & Electrical Engineering, Jamalpur, P.O. Jamalpur, Monghyr.

Delhi

197. AM 4455 N. P. Mathur (C)
Staff Officer II, Designs, DGBR, Kashmir House, New Delhi 11.

Gujarat

49. M 2117 H. P. Oza (C)
Director, Engineering Research Institute, Baroda.

Madhya Pradesh

35.	AM	6440	B. G. Baljekar (C) 2 Street 17 Sector IX, Bhilai.
36.	AM	8012	S. Banerjee (M) Assistant Superintendent, Heavy Rotating Plant, Manufacturing Department, Heavy Electricals (I) Ltd., Bhopal.
37	AM	5776	Dr. H. R. Chablani (E) Head of Electrical Engineering Department, Maulana Azad Engineering College, Bhopal.
38.	AM	10473	S. M. Dasgupta (E) Principal, G.S.T. Institute, Indore.
39.	AM	7396	D. Dhar (E) Assistant Chief Engineer, Transformer Department, Heavy Electricals (India) Ltd., Bhopal.
40.	AM	4732	S. N. Gandhi (E) Principal Technical Officer, Permali Wallace Ltd., Central India Flour Mills Estate, P.B. No. 38, Bhopal.
41.	AM	8364	Dr. A. K. Goswami (E) Chief Engineer, Industrial Machines Department, Heavy Electricals (India) Ltd., Bhopal.
42.	AM	7543	R. N. Juneja (M) Assistant Superintendent, Steam Turbine Manufacturing Department, Heavy Electricals (I) Ltd., Bhopal.
43.	AM	10549	V. L. Khular, (M) 6A Street, 22 Sector, Bhilai.
44.	AM	8228	R. Krishnamurthy (E) 112 Type 3 Piplani, Bhopal.
45.	AM	5986	K. M. Kukreja (M) Assistant Chief Mechanical Engineer, Bhilai Steel Plant, Bhilai.
46.	AM	5377	B. K. Lakshninarayana (C) Assistant Chief Engineer (C), Heavy Electricals (India) Ltd., Bhopal.
47.	AM	4137	B. G. Naik (C) Housing Commissioner, M.P., Bhopal.
48.	AM	10345	J. V. Nagaraja (M) Head-in-Charge, Mechanical Engineering Department, Maulana Azad Engineering College, Bhopal.
49.	M	2529	T. V. Pathasarathy (E) Commercial Manager, Heavy Electricals Ltd., Bhopal.
50.	AM	6006	M. J. Sane Assistant Manager, Jamul Cement Works, P.O. Jamul Cement Works, District Durg.
51.	AM	12993	T. K. Sastri (M) Chief Inspector, Heavy Electricals (India) Ltd., Bhopal.
52.	AM	3485	Harbans Singh, (E) General Foreman (Maintenance & Construction), Bhilai Steel Plant, Bhilai.

Mysore

38. AM 11284 V. Chandrasekhar (PH)
Reader in Civil Engineering, Manipal Engineering College, Manipal.

39. AM 12468 N. Madhava Murthy (C)
Lecturer, M.E.I. Polytechnic, Bangalore 10.

40. AM 13308 P. Muni Setty (M)
Lecturer in Mechanical Engineering, University College of Engineering, Bangalore 1.

41. AM 8817 T. Radhakrishnan (ET)
Reader in Electrical Engineering, Manipal Engineering College, Manipal.

42. AM 6059 Y. V. Rama Das (M)
Reader in Mechanical Engineering, B.M.S. College of Engineering, Bangalore 19.

Poona

48. M 2361 A. A. Noronha (C)
C/o. Chief Engineer, Poona Zone, Manekji Mehta Road, Poona 1.

Uttar Pradesh

126. AM 9955 Maj. S. K. Bhal (ET)
9 Mountain Division, Signal Regiment, Agra Cantonment.

127. AM 10822 Capt. H. C. Dhodapkar, (ET)
1 Armoured Division, Signal Regiment, Jhansi.

128. AM 5279 S. B. Gupta (M)
Assistant Inspecting Office, C/o Deputy Director of Inspection, 4/286 Nawabganj, Kanpur.

129. AM 6753 V. P. Mankhand (MM)
Kohinoor (India) Private Ltd., Kohinoor Buildings, University Road, Varanasi.

130. M 2304 P .N. Menon (MM)
Hindustan Aluminium Corporation, Renukot, District Mirzapur.

131. AM 3912 M. M. Misra (ET)
Director of Telegraph Coaxial Cable Project, Agra.

132. AM 9571 Flt. Lt. P. S. Rajagopalan (ET)
2 Officers Mess, Air Force Station, Agra Cantonment.

133. AM 10841 Maj. Y. Ramchandran (MM)
15 Party Survey of India, Dehra Dun.

134. AM 9416 Maj. B. P. Upasani (ET)
1 Armoured Bridge Signal Company, Babina Cantonment, District Jhansi.

The following are corrections to the addresses of Referees under **Delhi Centre,** published in the *Bulletin* for March 1965.

17. M 2419 B. B. Basu (C)
Superintending Engineer MES (Retd.), A/26 Hauz Khas Enclave, New Delhi 16.

74. M 2940 Col. M. P. Joseph (C)
Deputy Chief Engineer, Headquarters XV Corps, C/o 56 A.P.O.

75. M 2567 Brig. P. D. Joshi (C)
CE HQ XV Corps, C/o 56 A.P.O.

INSTITUTION NEWS

Donations by Members to Headquarters Building Fund

Messrs. Jessop & Co. Ltd., Calcutta, have made a generous contribution of Rs. 10,000 to the Fund. This is gratefully received and letter of thanks has been sent by the Secretary to them.

A list of members who have contributed to the Building Fund as on July 31, 1965, is given below. These donations are gratefully received.

Members	Donation
S. A. Prabhu (*Member*)	Rs. 30.00
G. T. Gokhale (*Member*)	Rs. 60.00
C. Roy (*Student*)	Rs. 10.00
G. P. Tiwari (*Associate Member*)	Rs. 30.00
P. S. Raman (*Graduate*)	Rs. 5.00
T. T. Gopalakrishnan (*Student*)	Rs. 10.00
M. K. Selvarajan (*Student*)	Rs. 10.00
A. P. Chourasia (*Student*)	Rs. 5.00

Inventions Promotion Board

The Inventions Promotion Board is a special autonomous organization set up by the Government of India for fostering research and development of inventions by independent scientific workers, technologists and research institutions in India. The Board aims at providing facilities, financial assistance and prizes for successful research on significant improvements in technology and inventions by technicians, inventors and small industries. It is well known that the country is struggling for technological progress which demands not only theoretical knowledge on scientific principles and technical knowhow of production, but also thorough grasp of the problem from the conception of the idea stage to practical research, application, commercialization, etc. To achieve its objective, the Board aids the inventor with technical and financial assistance to meet (i) expenditure for designing, drafting, and preparing detailed drawings, etc.; (ii) cost of fabrication of models; (iii) charges for use of equipment of laboratories or workshops for fabrication of equipment; and (iv) cost of patenting.

The Board is at present housed at 22 Pusa Road, New Delhi 5, and applications for financial assistance can be obtained from this address.

Third Specialized Training Course in 'Economic Design of Multistoreyed Buildings'

A specialized training course in 'Economic Design of Multistoreyed Buildings' is to be conducted by the Civil Engineering Department of Indian Institution of Technology, Guindy, Madras, from October 11 to December 31, 1965, under the auspices of the National Buildings Organization. The course is open to practising engineers in different organizations and teachers from technical institutions.

Further details can be obtained from the Joint Director, (Designs), National Buildings Organization, Exhibition Grounds, Mathura Road, New Delhi.

Structural Engineering Research Centre, Roorkee

The Council of Scientific and Industrial Research, Government of India, has created a new Structural Engineering Research Centre at Roorkee. The Structures Division which was previously a part of the Central Building Research Institute, Roorkee, now forms the nucleus of the newly created Centre. Prof. G. S. Ramaswamy has taken over as the Head of the Centre.

This Centre will develop as a school of research and training in theoretical and experimental stress analysis and design of complicated structures. Specialized methods of construction will be studied and development work on problems connected with buildings, bridges, and other structures will be taken up. When fully developed, the Centre will also provide facilities for advanced training to practising structural engineers.

ACTIVITIES OF THE LOCAL CENTRES AND SUB-CENTRES

Mysore Centre

Following the commissioning of the first generator in the Sharavathy hydro-electric power station and the prospects of a larger block of power being available in Mysore State, multifarious problems have arisen in the handling, distribution and utilization of this power in that State. The Mysore Centre of the Institution will be playing an important part in finding solutions to these problems and is now in the process of actively cooperating with the Mysore State Government in this regard.

The installed capacity in the Mysore power system in 1962-63 was 217 MW, with a firm capacity of 157 MW. The commissioning of the first stage of the Sharavathy project would take this firm capacity to about 320 MW, that is to say, the available power will be almost doubled in a short time. In the next few years, the firm capacity would rise to 770 MW, with an installed capacity of 1;000 MW. The resultant power distribution and utilization problems become obvious.

The Sharavathy project has therefore posed a challenge to the various government departments in the public sector which are involved in industrial and agricultural activity. The Electricity Board is faced with the problem of handling the new large block of power and distribute it within a reasonably short time. The Public Works Department has to meet the problems of communication, housing and water supply. The Revenue Department has to provide non-agricultural land available for industrial development. The educational institutions, both technical and scientific, will have to provide the required technical and managerial manpower. The transportation system within the State, both road and rail, will have to be geared to handled approximately five times the present transport load.

The Mysore Centre is now assisting in finding possible solutions to some of the technical problems involved and in coordinating the effects of other agencies who have taken up work on allied problems. A series of seminars are being organised, and the proposed subjects include (i) prospects of mineral-based industries in Mysore State; (ii) prospects of agriculture-based industries ; (iii) prospects of industries based on forest resources; (iv) better utilization of water resources; and (v) load growth problems required for statewide distribution. The inauguration of the series was made recently by the Governor of Mysore, Shri V. V. Giri.

Discussions on the above subjects will be held amongst those who are conversant with the problems connected with each of them. Suggestions made at each seminar will be further discussed in small study groups. The conclusions thus arrived at will be published as reports which, it is hoped, will be useful to industrialists for undertaking new ventures. These reports will also be submitted to the State Government, with a view to assist it in assessing the facilities and concessions that may need be afforded to the industrialists for establishing new industries. The discussions are envisaged to take into account all the indigenous raw materials available in the State, and to suggest ways and means of how these indigenous materials can be put to best use so as to reduce dependence on imported materials.

It is proposed to have much of this work done at the Mysore Engineers Research Centre, the establishment of which was proposed as a result of the amalgamation of the Mysore Engineers' Association with the Institution last year.

Further enquiries may be addressed to the Honorary Secretary, Mysore Centre, The Institution of Engineers (India), No. 3 Vidhana Veedhi, Bangalore 1, who will be glad to answer enquiries of a specific nature.

Ranchi Sub-Centre

The Ranchi Sub-Centre of the Institution is holding a Symposium on, Prefabrication of Buildings' at Ranchi on September 26, 1965. Prof. M. S. Thacker (*M.*), Member of the Planning Commission, and Chairman of the Committee of Engineers for Recommending the Use of Prefabrication in the Construction of Government Buildings, is expected to preside.

Papers are invited on the following topics by the Convenor, Symposium Sub-Committee, and should reach him by September 15, 1965.

1. Fully mechanized methods of prefabrication and erection of buildings
2. Semi-mechanized methods
3. Application of modular coordination method in prefabricated buildings
4. Architectural aspects on prefabricated construction
5. Economics of prefabricated construction (ultimate economy over conventional methods and its suitability in India)

Further details can be obtained from Shri S. R. Kar Roy, Convenor, Symposium Sub-Committee, The Institution of Engineers (India), Ranchi Sub-Centre, P.O. Hinoo, Ranchi.

FORTHCOMING CONFERENCES

Tenth Irrigation and Power Seminar, Durgapur, October 29 to November 2, 1965

The Tenth Irrigation and Power Seminar will be held at Durgapur from October 29 to November 2, 1965. The following subjects are included for discussion at the Seminar.

Irrigation

1. Report on ways and means for improving the financial returns from irrigation projects (Nijalingappa Committee Report)
2. Actual utilization of earthmoving equipment during the last three years (1962-65)

Power

3. Power tariff pattern for India
4. Report on financial working of State Electricity Board (Venkataraman Committee Report)

Miscellaneous

5. Importance of thorough investigation of potential hydro power project sites.

Copies of the Nijalingappa Committee Report and the Venkataraman Committee Report are available from the Central Water and Power Commission (Water Wing), Government of India, New Delhi 1.

Papers on the above topics are invited by the Deputy Director (Seminar), Central Water and Power Commission, from whom further details of the Seminar can also be obtained.

Symposium on Water Pollution Control, Nagpur, December 1965

The Central Public Health Engineering Research Institute, Nagpur, will hold a Symposium on 'Water Pollution Control' in Nagpur at the end of this year. The aim of the Symposium is to provide an opportunity for different groups of people concerned with and responsible for water pollution control, to discuss in detail the various aspects of the problem and help the implementation of the Central Water Pollution Control Act of the Ministry of Health which is before the Parliament for discussion.

Many industries such as paper, distillery, tannery, textiles, steel and oil refinery, use considerable quantities of water for their processes and discharge a major portion of this water as liquid waste. Some of these liquid wastes contain acids, alkalis, toxic elements (inorganic and organic) and non-toxic materials that demand oxygen from the receiving waters. These industrial wastes, if discharged carelessly into the water courses, will be a potential hazard to the public health. Similarly, if untreated sewage is lef out into streams, it will create a number of problems.

It is expected that this Symposium will stimulate interest of the engineers, scientists, industrialists and public health administrators to think of ways and means to economically control water pollution and restore our valuable water resources for the urgent needs of our rapidly urbanising and industrialising communities.

Papers on any of the following subjects will be discussed during the Symposium.

1. Sewage treatment
2. Stream sanitation
3. Inustrial waste treatment
4. Tertiary treatment and re-use of effluent

An abstract of the paper along with two copies of the full paper should be sent to the Central Public Health Engineering Research Institute before September 15, 1965. The paper should not have more than 3,000 words and the number of tables and/or graphs should not exceed ten.

Further information can be obtained from Dr. C. A. Sastry, Convener-Symposium, CPHERI, Nehru Marg, Nagpur 3.

Symposium on 'Some Aspects of Defence Metallurgy', Hyderabad, January 1966

A Symposium on 'Some Aspects of Defence Metallurgy' will be held at Hyderabad in January 1966, concurrently with the 19th Annual Technical Meeting of the Indian Institute of Metals.

Papers, not exceeding 5,000 words in length, on the subject are invited by the Institute.

Further details can be obtained from the Joint Honorary Secretary, The Indian Institute of Metals, 31 Chowringhee Road, Calcutta 16.

Ninth Indian Standards Convention, Bangalore, December 13-18, 1965

The Ninth Indian Standards Convention will be held at Bangalore, from December 13 to 18, 1965. The highlights of the technical programme include discussion on the following subjects :

1. Expediting peparation of Indian Standards
2. Cost reduction through standardization
3. Extending usefulness of I.S.I. Certification Marks
4. Implementation of agricultural and food standards
5. Standardization in the field of welding
6. Crisis of shortage of building materials
7. Overseas collaboration and standardization in India
8. Documentation and library housing

Original contributions having direct bearing on some related aspect of standardization in the fields covered by the technical sessions are invited. Apart from technical sessions, visits to selected industrial units and places of historical and tourist interest, and social functions will also be arranged.

A special session will be held on December 17, 1965, to discuss the subject of 'Standardization as a Tool for Export Promotion' under the Chairmanship of Shri Manubhai Shah, Union Minister for Commerce.

Further details of the Convention can be obtained from the Director, Indian Standards Institution, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 1.

International Seminar on 'Automatic Control in Production and Distribution of Electrical Power', Brussels, April 18-22, 1966

The Institut de Belge de Regulation et d' Autonatime and the Societe Royale Belge des Electriciens will organize an International Seminar on 'Automatic Control of Electrical Power' in Brussels from April 18 to 22, 1966. The theme of the Seminar is to strike the balance of the contribution of automation techniques to exploitation reliability and to power production and distribution optimization by an international meeting of automation specialists and power utilities staff. The following subjects will be discussed at the Seminar.

Automatic control in electrical power production

(i) Automatic control of boilers
(ii) Automatic control of turbo-generator sets
(iii) Automatic start-up procedures
(iv) Utilization of computers for the purpose of supervising performance evaluation and automatic monitoring of power generation units

Automation load distribution between production centres

Automatic control of electrical power transmission.

(i) Most recent progress made in the design of control rooms for main power stations
(ii) Trends in the development of automatic control of networks

Authors wishing to contribute papers for the Seminar should communicate the exact subject of their paper and an abstract of two typed pages in single line spacing before September 30, 1965.

Further details can be obtained from : Secretariate de L'I.B.R.H., 3 rue Revenstein, Brussels, Belgium.

Symposium on 'Effect of Repeated Loads on Materials and Structures', Mexico City, September 15-17, 1966

At the last meeting of the Permanent Committee of RILEM, it was decided to hold a Symposium on the 'Effect of Repeated Loads on Materials and Structures' in Mexico City from September 15 to 17, 1966. It is expected that this Symposium will be of considerable interest to all those concerned with the design and application of prestressed concrete.

BOOK ACKNOWLEDGMENTS

1. **Engineering Economics, Vol. 2—Industrial Organization and Management.** Tara Chand. *Nem Chand & Bros.*, Roorkee. Rs. 11.25, 1963, 584 pages.

This book originated as an attempt to present a view of the operations of the industrial organization, the interrelationship of functions, and the fundamental principles of management that lead towards effective coordination and control. A sketch of the integrated science of management made up of separate and identifiable skills' of which the organization is a vital element, is given in the book.

2. **A Basis for Integrated Planning.** Published by the author. Rs. 1.20, 1954, 50 pages.

In this book, the purpose of a national plan and its aims and policy, the approach to the planning task, and the choice of an educational system to form the basis of an integrated plan are explained.

3. **The Bending and Stretching of Plates.** E. H. Mansfield. *Pergamon Press,* 45s, 1964, 148 pages.

An exposition of the small and large deflection plate theory together with a clear physical understanding of plate behaviour, analysis of plates of variable thickness, certain approximate methods in the small and large deflection theory and the inextensional theory are given in this book.

4. **Skew Plates and Structures.** L. S. D. Morley. *Pergamon Press,* 45s, 1963, 128 pages.

Fundamental equations for plane stress, in the rectangular and oblique cartesian coordinate systems, for an isotropic which is reinforced by one or more systems of parallel straight members uniformly distributed over the surface, are given in the first part of the book. A study is made of the small deflection bending of plates using the oblique and polar coordinate systems in the second chapter. Emphasis is given on the need to recognize the singular behaviour which occurs in the bending and twisting moments to any obtuse junction with a simply supported plate using the polar coordinates. A formal analysis is given for a swept box structure in the concluding portion of the book.

5. **A Text-book of Electrical Technology.** B. L. Theraja. *Niraj Prakashan,* New Delhi, Rs. 25, 1965, 1606 pages.

This revised and enlarged fourth edition of the book has been presented in the rationalized M.K.S.A. system of units in order to meet the requirements of engineering degree students as well as diploma students. New material added in the book are the chapters on 'Harmonics' and 'Transients'. The chapters on 'Traffic and Economic Consideration', 'Network Theorems' and 'Testing of D.C. Machines' have been revised and enlarged.

6. **Telecommunications, Vol. 1—Principles of Telecommunication.** J. Brown and E. V. D. Glazier. *Champan and Hall Ltd.,* 45s, 1964, 370 pages.

This low-priced text-book deals with the general principles of telecommunication. The book is designed to meet the needs of university or technical college students reading for a first degree or a diploma in technology. The reader is assumed to have a good knowledge of A.C. circuit theory and an elementary knowledge of electromagnetic wave propagation and electronic theory. Since the Fourier integral method of dealing with non-periodic waveform is the most instructive approach to a study of telecommunication principles, the main text is largely concerned with providing a physical grasp of the essentials of this method. A detailed mathematical treatment including the relation to other methods of network analysis is given in Appendix A. Appendix B deals with Bessel functions.

PUBLICATIONS RECEIVED

A copy of the Special Report No. 1 entitled 'Puzzolanic Clays of India, Their Industrial Exploitation and Use in Engineering Works' has been received from the Central Road Research Institute, New Delhi. Part 1 of the report gives a survey of puzzolanic clays throughout the country, and is expected to be of interest to both industrialists and engineers in charge of civil engineering projects. Part 2 is meant mainly for the manufacturers for the exploitation of located desposits. Part 3 of the report deals with the utilization of reaction *surki* in various types of construction.

A copy of the publication entitled 'Indian Standard Guide for the Selection of Fits' has been received from the Indian Standards Institution, New Delhi. This guide gives recommendations for relation of fits in engineering problems concerned with the mating of a shaft and a hole. These recommendations are also applicable to non-cyclindrical fits. The guide gives in the form of illustrative examples, the representative usage of various classes and grades of fit. These examples are only of an illustrative character and they do not specify any design details.

A copy of a booklet entitled 'Soviet—Indian Economic Cooperation' by I Sokloc has been received from the Information Department of the U.S.S.R. Embassy in India, New Delhi. This booklet, issued on the occasion of the completion of a decade of Soviet-Indian Cooperation (1955-65) which began with the signing of the Bhilai Agreement in February 1955, illustrates the achievements in the economic sphere during the period.

A copy of a booklet entitled 'Bhilai-Symbol and Portrait' by G. K. Sinha has been received from the information Department of the U.S.S.R., Embassy of India, New Delhi. This booklet gives the progress made in the Bhilai steel plant.

OBITUARY

The sympathy of the Institution is extended to the relatives of those whose passing is recorded here

Shri C. B. Doshi

Shri Chunilal Becharlal Doshi, B.E., A.M.I.E., died on June 1965, at the age of 56.

Born in 1909, Shri Doshi graduated from the Bombay University in 1930, obtaining his B.E. degree in Civil Engineering. He started his career as Assistant Surveyor in the Irrigation Department of the then Bhavnagar State in 1930. He served the Governments of Saurashtra and Gujarat in various capacities and rose in position from Deputy Engineer to Superintending Engineer. During his professional career, Shri Doshi was responsible for the design and construction of some water supply and irrigation schemes in the Saurashtra and Kutch areas.

Shri Doshi joined the Institution as Associate Member in 1952.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organisations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column, a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

A QUALIFIED CIVIL ENGINEER, D.C.E., A.M.I.C.E., Grad. I.E. (India), 32 years old, good personality with sound physique, having an overall experience of 11 years in surveying, estimating, planning and organising and construction of buildings (residential, factory, multistoreyed), roads, heavy machine foundations, major bridges, and R.C.C. works of substantial volume in Government projects, well conversant with design and drawing work too, presently working as Civil Engineer in first class contractors firm, seeks a suitable change. Salary expected Rs. 1,100.00 per month. (Office ref. E.S. 201).

ELECTRICAL ENGINEER, B.E.E., A.M.I.E., age 31, ten years experience in power supply system, particularly in designing, planning, erection, commissioning, maintenance of transmission/distribution lines, sub-stations ; and also in procurement of materials, seeks suitable change in or around Calcutta. (Office ref. E.S. 202).

YOUNG MECHANICAL ENGINEER, with Master's Degree in Power Engineering (Mechanical-Thermal), A M.I.E., age 32, with over one year training at a large modern thermal power station in erection, operation, maintenance, instrumentation, testing, etc., experience of about two years in erection, supervision of large thermal power station, over five years as Sales Engineers handing thermal generation equipment (turbosets) of well known European manufacturers, attended six months Sales Engineers Training Course at manufacturers, seeks senior position in sales or project work, preferably in Bombay. Present salary over Rs. 1,000 p.m. (Office ref. E.S. 203)

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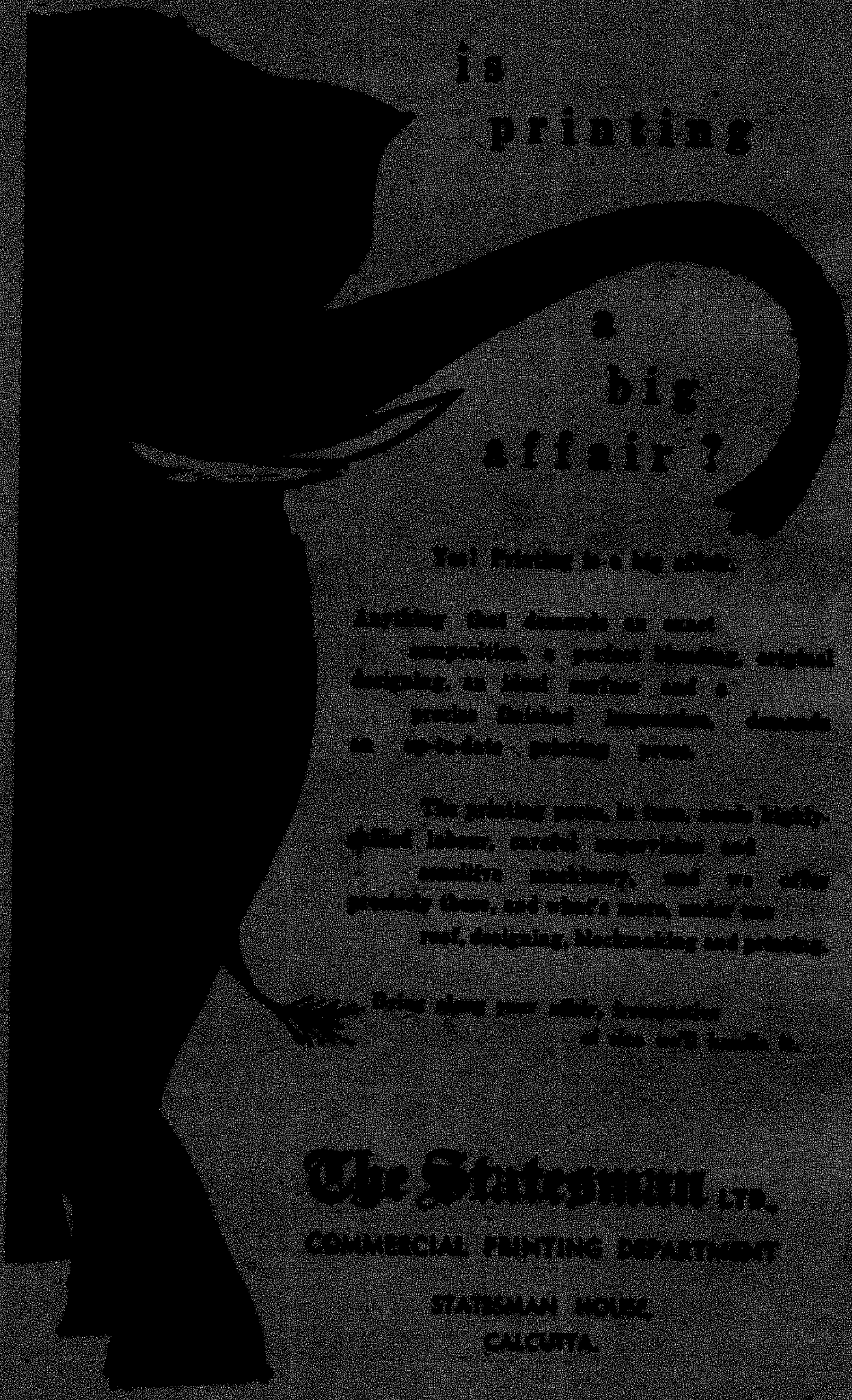

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